

**AN EXPLORATION OF IMPACTS OF AQUACULTURE
PRODUCTION AND MARKETING ON RURAL LIVELIHOODS
IN THREE REGIONS IN BANGLADESH**

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By

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**Dedicated
To
My late father
My mother
and
My family**

In the name of All-mighty Allah

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Declaration

I hereby declare that this thesis has been composed entirely by myself and has not been previously submitted to any other degree or qualification. The work of which it is a record has been carried out by me. The nature and extent of any work carried out by, or in conjunction with, others has been specially acknowledged by reference.

Golam Faruque

Abstract

Increased domestic and international demand for aquatic foods have greatly enhanced aquaculture practices and production in Bangladesh, which is reflected in the national economy. However, the impacts of a fast growing aquaculture sector through the involvement of stakeholders, poorer sections throughout the value chain and broader rural livelihoods are largely underdeveloped and have frequently been ignored. The present study explores the impacts of dynamic aquaculture sector on stakeholders at production level and supply chain and test the hypothesis that aquaculture is enhancing rural livelihoods and benefiting the poor.

Three aquaculture production systems in three areas of Bangladesh were selected for the study. These were prawn production in *gher* system in Jessore, pond fish culture in Mymensingh and rice-fish farming in Dinajpur. This selection allowed analysis both the impacts of domestic and export marketing of aquaculture products. Participatory research data collection tools; focus group discussions and participatory mapping were commonly used along with questionnaire surveys to ensure participation of stakeholders.

Aquaculture, in general, found to have had significant impacts on rural livelihoods. The greatest effect of aquaculture on farming households were observed in income and consumption. Integrated aquaculture systems were the regular source of fish and vegetables and constitute more than half of the fish and vegetables consumed by farming households. While income from aquaculture was the highest among the several household income sources, the main cash crop differed between the systems studied. Prawn, fish and rice was the main cash earning crops for *gher* farming, fish farming and rice-fish farming respectively. Qualitative investigation suggested that aquaculture not only increased income through greater production volume, but also improved farmers' assets through income diversification to farm and non-farm

sources. The other important outcomes of aquaculture were the enhancement of social safety nets through increased sharing of inputs and labour among farmers.

Commonly the aquaculture systems were found to be more intensive with an increasingly commercial attitude over the last ten years, which affected the intra-household labour distribution leading to a greater role for women in production management. While the three activities; fish feed preparation, feeding and growing vegetables performed by vast majority of women could be attributed to their inherent involvement with agriculture, hard physical work like harvesting ponds and pond construction were mostly carried out by the women from poor households as a strategy to reduce hired labour cost. The women's' increased involvement in aquaculture not only increased their overall workload, but also empowered them in household decision making to some extent. However, involvement in decision making was related to the level of involvement in production activities.

The impacts of aquaculture spread beyond the farming households to the broader rural livelihoods. Wage labourers and fishers (harvesting teams) two of the poorest groups of people directly involved were benefited most over the last ten years. Intensification of aquaculture increased the demand for hired labour leading to a structural shift in the agricultural wage labour market in farming communities. About half of the agricultural labourers were found part-time employed in aquaculture activities in Jessore and Mymensingh. In Dinajpur intensification of rice cultivation had a much higher effect on the demand for labour than aquaculture. Increased employment in rural areas increased real labour wages by about one fifth over the last ten years and subsequently improved livelihood outcomes.

Declining fish catch due to both decreased natural fish stocks and more restricted property rights, professional fishers benefited by diversifying their livelihoods into the aquaculture sector. While, many of the fishers permanently changed their profession to prawn marketing in Jessore, the rest were full-time or part-time employed in

harvesting ponds and/or retailing fish in markets. Such diversification of income greatly reduced seasonal vulnerability and improved livelihood outcomes.

The role of fish marketing, which is a critical institution in rural livelihoods, was found to facilitate the growth of the aquaculture sector. High demand of aquatic products and the diverse options of marketing fisheries enabled farmers to meet their initial requirements. More commercial operations of aquaculture increased farmers' awareness and linkages to markets. However, typically the worse-off farmers were the slowest to capture new market opportunities, often due to their poor resources and human capital.

Fish marketing was found to be run by the private sector and government provided the infrastructure facilities, except prawn processing plants, which were developed by private sector. While the fish market transactions were fairly efficient, markets facilities and infrastructure were commonly poor and need of government investment for improvement. A gradual growth of fish and markets in the rural areas was observed in the study; this was driven by the increased demand for fish through increased population and supply from aquaculture. The marketing intermediaries provided important services despite their small share of consumers' price and ensured a fair share for farmers. The auctioneers provided a vital role in running the supply chain with investment and credits, which ensured fair competition in the pricing process.

Marketing of aquatic products was not only a mechanism of product transaction, but also provided critical livelihoods for rural poor. On average about one hundred people, including retailers were involved in auction markets and eight people in prawn depots. Importantly the number of people in marketing was found to have increase over the years. Access for different groups of poor people to marketing jobs was found to be significant in rural livelihoods. The asset base and daily earning indicates that more than three quarters of the marketing intermediaries were poor;

some of them were from poorest and low cast Hindu society. Greater flexibility of entry and exit to the jobs enabled the poorer sections to diversify their livelihoods, which enabled to cope with seasonal variability of opportunities and stable income. The marketing employment provided then increased livelihood welfare and social security.

Finally, it can be concluded that the promotion of aquaculture not only increased much needed food availability but also generated critical livelihoods and marketing is not just a mechanism of product flow, but also providing livelihoods welfare to poorest sections of the society. The micro level findings of the study regarding impacts of aquaculture indicate that aquaculture production and marketing have significant impacts on enhancing rural livelihoods in Bangladesh.

List of Abbreviations

ADB	Asian Development Bank
BBS	Bangladesh Bureau of statistics
CPD	Centre for Policy Dialogue
DANIDA	Danish International Development Agency
DFID	Department for International Development
DoF	Department of Fisheries
FAO	Food and Agriculture Organisation of the United Nations
FGD	Focus group discussion
GDP	Gross domestic product
GoB	Government of Bangladesh
Ha	Hectares
HYV	High yielding variety
KI	Key informant
NGO	Non-government Organisation
UNDP	United Nations Development Programme

List of Glossary

<i>Amon</i>	Rain fed rice cultivation season (July -November)
<i>Arot</i>	Auction house
<i>Baor</i>	Closed water body equivalent to an oxbow lake, up to several
<i>Beel</i>	A natural depression retains water and usually common fishing ground in monsoon
<i>Boro</i>	Irrigated rice cultivation season (May – June)
Community	A neighbourhood, cluster of households within a village
<i>Depo</i>	prawn buying depots
<i>Foira</i>	marketing intermediaries buy fish/prawn from farmers at farm gate
<i>Gher</i>	An enclosure made for prawn cultivation by modifying rice fields
<i>Haor</i>	Low lying areas that are seasonally flooded, normally for 5 to 6
Homestead	land Yard or compound of household
Household	A family unit stay together and use common resources for
<i>Koilder</i>	assistant to auctioneers
<i>Kuli</i>	Wage labourer involved in loading and unloading fish and other materials
<i>Paka road</i>	Bituminous road
<i>Purdha</i>	Socio-cultural norms and restrictions for women in Bangladesh
Taka	Bangladesh unit of currency; US\$ 1= Tk 62 in 2004
Thana	An administrative unit in Bangladesh equivalent to a sub-district.
Union	A lowest local government structure

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CHAPTER 1 Background of the research

1.1 General introduction

Aquaculture has gone through major changes ranging from small-scale homestead-level activities to large-scale commercial farming in the last two decades (Pillay, 2001). In The People's Republic of Bangladesh (Bangladesh) conventional aquaculture has evolved from traditional practice to science-based activities and has become the second largest (6%) contributor to national exports (DoF, 2002). At the same time a variety of noble aquaculture production systems have been developed and spread through innovative approaches to farming communities in Bangladesh, some have already proven to be significant contributors to overall production (Ali, 1996). However, benefits through involvement of the poor producers and non-producers in servicing aquaculture and formal and informal marketing are unclear and have frequently been ignored. The overall impacts of a dynamic aquaculture sector on producers, consumers, and market channel intermediaries must be better understood if efforts towards targeting benefits to the poorest people are to be effective. This research will analyse the impact of aquaculture production and marketing on rural livelihoods and will test the assumption that aquaculture is benefiting the poor stakeholders throughout the value chain. Since the research is "people centred" the assessment has been carried out in the light of "aquaculture for development and poverty reduction" as a whole.

"Eradicate extreme poverty and hunger" is the number one Millennium Development Goal (MDG) employed by the United Nations (UN) (United Nations, 2006). To measure the progress and success of the goal, two indicators are formulated: i) reduce by half the proportion of people living on less than USD 1 a day and ii) reduce by half the proportion of people who suffer from hunger (United Nations, 2006). The main focus of FAO programmes for the millennium is to break the vicious circle of

poverty and food insecurity by placing food security at the top of the agenda (Jia et al. 2001). However, food insecurity i.e. hunger is the key indicator of poverty and can be measured by the daily calorie intake of individuals. Compared to the average food intake (2200 kcal/day/person) about 800 million people, mostly from developing countries, are still undernourished (Larson, 2002; Scherr, 2003; Branchflower, 2004). In the light of progress during the last three decades the World Bank projected that the number would be reduced to 610 million in 2015 and to 440 million in 2030 (World Bank, 2003). However, despite this projection, actual progress has been slow in last five years (FAO, 2000b). Therefore achieving the target remains a challenge. In terms of numbers, the greatest concentration of food insecure people remains in Asia and the Pacific (FAO, 2000b). Bangladesh is one of these poor countries where about half of the people live below the poverty line. Despite, the present positive growth of the economy at the rate 5.8% in 2005 (WEF, 2006), poverty remains a burning issue. Eradicating extreme poverty is the biggest challenge for the country. However, the country has enormous potential to achieve the MDGs (Branchflower, 2004).

1.1.1 Research context

Bangladesh, like many other developing countries, has developed and is implementing policies for poverty reduction based on Poverty Reduction Strategy Papers (PRSP), within which aquaculture is an important option (DoF, 2005). During the last two decades, a number of development projects have been implemented. These have been led by the Government's Department of Fisheries (DoF), donor agencies and national and international non-government organisations (NGOs) individually or in collaboration (Islam, 2002). Donors in the agricultural sector have supported aquaculture development with different projects through financial and technical interventions. National and international NGOs have played a key role in implementing those development projects and disseminating aquaculture technologies (Islam, 2002). The context of the current study can be linked with the Northwest Fisheries Extension Project (NFEP 1991-2001) which was a bilateral project between

Government of Bangladesh and the Department for International Development (DFID). The author served NFEP for 10 years (1992-2001) in extension, training and within several trial programmes.

The Northwest region of Bangladesh is generally considered to be one of the poorest in the country (WFP, 2002). The regional economy is predominantly agricultural and is vulnerable to climatic variability (CARE, 2005b). The majority of people are engaged in agriculture with large numbers of the poor working as daily labourers or sharecroppers. Scope for the poor people to benefit from wild fish supplies was in decline (NFEP, 2001). In that context, NFEP played a significant role in aquaculture technology development and supporting poor fish farmers (NFEP, 2001). Initially the project developed a fish hatchery for ensuring fish seed to the region, assuming that the region was lacking fish seed availability as on the assumption that the region was lacking fish seed availability as there was no evident of productive fish hatchery available. However, later it was found that there were well developed and extensive private sector seed supply channels from distant districts like Jessore, Bogra and Rajshahi (Lewis et al 1996). It was also found that aquaculture practices were very undeveloped in the region and many of the household ditches were unused due to a lack of knowledge. Therefore, the NFEP focused on developing low cost production technologies and suitable extension approaches to disseminate required technologies. The NFEP developed tilapia and shorputi based polyculture for seasonal ponds suitable for the region. It also developed and disseminated rice-fish farming technology and tested cage aquaculture as an activity for women. A number of innovative extension approaches were developed to disseminate the technologies to farmers, focusing upon the poor and those in greatest need of technical knowledge (Morrice, 1996; Islam, 2002). Many of the later projects, like INTERFISH Project, managed by CARE Bangladesh, were developed on the basis of the NFEP technology and extension innovations. Effective implementation of the programmes improved farmers' aquaculture practices to a great extent resulting in increased fish yields and

greater levels of household fish consumption and income (Morrice, 1996). During the duration of NFEP, a bilateral project between DFID and CARE Bangladesh named Greater Option for Livelihood Development Alternatives (GOLDA) was involved in developing good practices for prawn farming in the *gher* systems of the south-western region. The Mymensingh Aquaculture Extension Project (MAEP), funded by the Danish International Development Agency (DANIDA) also worked with pond fish farmers in the central north region in Bangladesh. The prime aim of these projects was to improve socio-economic conditions of farming households through increased fish production, by adopting improved technological practices. A further aspect of the interventions was to improve women's role in income generating activities by involving them in aquaculture to address the issue of gender equality. Women's involvement in income generating activities has increased in recent years, mainly through NGO's micro-credit programmes (Islam, 2005). The female cage farmers from CARE CAGES project, managed cages jointly with their husbands (Menon, 2000). However, women's increased involvement in agriculture has affected labour demand and intra-household labour allocation (Weinberger and Genova, 2005). While research has shown that, the division of labour had changed and that as a result women's workload was often considerably increased (Brugere et al. 2001), the impacts of their involvement in aquaculture as individuals and the household are poorly documented (Spring, 2001). A review of the impacts of woman's participation in aquaculture would help in better defining strategies to involve them in aquaculture.

While, as a result of NFEP and other project support, production increased through better aquaculture practices a number of other broader socio-economic issues began to emerge. The development of aquaculture, and the benefits derived therefrom, have faced criticism for their lack of clear impacts on the poor (Ahmed, 1992b; Thompson et al. 2000). This was because the adoption of these technologies and its impacts on broader rural livelihoods, particularly whether it benefits the poor people, remained unclear. Growth of aquaculture can enhance the rural economy directly and indirectly

in many ways. In general, intensive agricultural production requires relatively high inputs of labour, which makes them pro-poor (GFAR, 2006). Muir (2005) suggests that a wide range of social and economic issues, are associated with aquaculture, its development and interactions and these are closely linked to national and international policies and, institutional features, and should be considered simultaneously.

The necessity of linking production to marketing was identified at the time of these earlier development efforts. However, a lack of information on fish marketing was found, and this was a significant constraint for assisting farmers for the development projects. A survey on the information/research needs with different levels of stakeholders on seven development projects conducted by Faruque and Thompson (2002) found that information on fish marketing was one of the priority needs for development projects. The projects realised that the marketing of fish at a fair price was as important as increasing fish production in terms of increasing income for farmers. Understanding post harvest issues in and around aquaculture may be challenging but critical. While fish marketing in itself is often complex, the quality aspects of prawn and shrimp have become key issues in terms of export marketing in Bangladesh. It has been widely assumed that aquaculture production has valuable potential to enhance pro-poor agricultural growth by broadening supply, consumption and employment opportunities in poorer rural households. The interactions between changing supply, prices, and livelihood impacts along the market chain from production to consumption, are important in determining the potential impact for appropriate promotional strategies. However, information on the changing role of supply, market structure and on the consequent allocation of benefits arising from investment in aquaculture is very limited, and the dynamics of these relationships are poorly understood. Furthermore, the strategic consequences in terms of changing competitiveness between small-scale producers and more organised commercial production is not sufficiently clear. At the same time, it is commonly viewed that marketing intermediaries take a large share of benefits of retail price from several

transactions. However, their role in marketing and their benefits through involvement in servicing aquaculture is and has been frequently ignored, probably because they are inherently complex and records are commonly either poor or not transparent. On the other hand, macro-level evidence from assessment of demand and consumption indicates increasing regional dependence on farmed aquatic production to meet needs for national food security and income (Ahmed et al. 2003). While significant change in output has occurred in rural environments, based on established species and systems, peri-urban production is becoming increasingly important and there are trends from small-scale to commercial levels of activity in different countries. Farmed outputs are leading to pronounced supply shifts and have led to changes in market mechanisms, shortening of supply chains and diversification of products and process (Ahmed et al 2003). In this context a DFID funded research project between Aquaculture and Fish Genetic Research Programme (AFGRP) and The WorldFish Center implemented during 2003-2005 covering a wider geographical area (Bangladesh, Vietnam and Thailand) to develop a regional perspective, based primarily on Bangladesh. The aim of this project was to assess the interactions between production technology, supply change, market evolution, and distributional consequences, to understand the key relationships and driving forces. The current research was a sub-set of the overall project research activities in Bangladesh and aimed to develop a clear understanding of the interactions and livelihood impacts of aquaculture production and marketing in order to contribute to future policy development. This research will test the hypothesis that aquaculture development delivers important benefits to the poor producers and non-producers.

1.1.2 Bangladesh

The People's Republic of Bangladesh is one of the largest deltas in the world, having covering an area of about 147,570 km² within the Ganges delta in Southern Asia, bordering the Bay of Bengal (Monan, 1995; Luo, 1993; Coutsoukis, 1999). According to the census conducted in 2001, the country's population was 123 million, making it

the most densely populated country on the Earth as well as the eighth most populated country (Luo, 1993; Coutsoukis, 1999; National Data Bank, 1998). About 80% of the people live in rural areas (FAO, 1999; BBS, 2004), but rapid urbanization is now under change and more people are expected to live in cities and towns in the near future. Despite the potential resources, nearly 36% of the population remains below the poverty line for the very poor (i.e. not able to eat food three times a day) and 53% below the poverty line for the poor (i.e. able to eat food, but lack of other basic needs) (World Bank, 1998).

The country has 8.13 million hectares (ha) of arable land, 5.43 million ha of freshwater, 15% woodland, natural gas and coal. The country enjoys generally a sub-tropical monsoon climate with three prominent seasons; winter, summer and rainy season. Average rainfall varies from 1429 to 4338 millimetres (BBS, 2004), while the average temperature ranges from a minimum 80 C in the winter to a maximum 370 C in the summer. The climatic condition and the natural land-water resources are suitable for a wide range of flora and fauna. The country's economy is traditionally agricultural based and supplemented by a generally favourable climate and resources (Ahmed, 2001; FAO, 2000a). The majority of the rural people use natural resources like land, water and biotic resources as the base of their livelihoods. As such, the agricultural productivity drives the rural economy and livelihoods (Hossain, 2004a). Despite the rapid growth of the garments industry over the last 20 years, the country's economy still remains dominated by agriculture which remains the most important source of income and employment in rural Bangladesh. Agriculture accounted for 22% of gross domestic product (GDP) in 2003 and employed 69% of the labour force (BBS, 2004). Overall, the performance of the sector has been very strong with agricultural GDP growing at an average annual rate of 4 % during the 1990s (CPD, 2002). However, during the past decade the sector has been undergoing a gradual transformation; the contribution of crops and horticulture, and livestock to total agricultural GDP has declined slightly (Dilworth, 1998). In contrast, the fisheries

sector has experienced a rapid growth to 23% of agricultural GDP, particularly in export earning (Table 1.1).

Table 1.1: Export of fisheries products during 2000-2004

	Years				
	2000	2001	2002	2003	2004
Amount (metric tonnes)	39391	38998	47371	54141	63338
Actual Value (million USD)	302	339	324	394	429
Value million USD weighted with inflation)	355	385	358	417	429

[Source: (Ahmed, 2005), Fish Fortnight Souvenir 2005; Inflation rate is listed in Appendix:4]

1.1.3 Fisheries and aquaculture sector of Bangladesh

Bangladesh is commonly known as the ‘country of rivers’ due to the large number of rivers flowing across the country is a prominent and important feature of its landscape (Bundell and Maybin, 1996). The landmass comprises mainly the delta of the three major rivers, the Ganges, the Brahmaputra and the Meghna (Chakraborty, 1998). The freshwater resources consist of 4.92 million ha of open water which includes rivers, estuaries, *beels* (natural depressions), polders (enclosures) and flood plain, and 0.51 million ha of closed freshwater which includes pond, ditches, oxbow lakes and *gher* shrimp farms (DoF, 2005). The country is rich with very productive marine and freshwater resources with enormous aquatic biodiversity (Mathias et al. 1998). Among the important aquatic animals, there are 260 freshwater indigenous fish species, 12 exotic species and 24 freshwater prawn, while there are 475 marine fish and 36 shrimp species in marine water (Ahmed, 2001).

The fish and fisheries sector play an important role in the country’s economy and socio-cultural life, providing food, employment and foreign exchange (Rahman, 1994a). The sector has been a longstanding and an indispensable part in the life and livelihood of the peoples of Bangladesh and is commonly regarded as part of the country’s cultural heritage (Ahmed, 2001). Although the contribution of fish to the

country's total animal protein intake has been declining over the years, it is still highly significant in the Bangladeshi diet, contributing about 63% of total animal protein (Ahmed, 2005). In Bangladesh, historically people catch fish from open and unmanaged waters. Even during the 1960s -70s, 80% of the fish consumed were harvested from natural sources (Ahmed, 2005). However, due to increased fishing effort by the growing population as well as environmental degradation, the harvest from such natural fish stocks has declined to about 34% of total fisheries production in 2005 and that from the culture of fish has increased significantly in enclosed waters over the last two decades (Ahmed, 2005; ADB, 2005). Total fish and fisheries production of in 2002-03 was 2.1 million metric tonnes (t) of which 37% was from inland freshwater aquaculture, 4% coastal aquaculture, 33% inland capture fisheries and 26% from marine capture fisheries (ADB, 2005; DoF, 2005). Major statistics of fisheries sector is shown in Table 1.2.

Table 1.2: Major fisheries resources and fish production (2003-04)

Resources	Area (ha)	production
Open water bodies	4,920,316 ha	732,067 t
Close water bodies	513584 ha	914, 752 t
Marine area (exclusive economic zone)	41,040 square nautical miles	455,207 t

(Source: DoF 2005)

1.1.4 Aquaculture: concept, practice and contribution

Aquaculture is farming fish and other aquatic organisms. Kruska et al. (2003) defined aquaculture as “the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants with some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc.” Farming also implies individual or corporate ownership of the stock being cultivated. However, this definition received criticism as it did not include management and harvest of natural stocks. If the management of natural water resources aims to enhance natural stocks or increase yield by individuals or a group, it can also be

considered as aquaculture (Beveridge and Little, 2002). In general aquaculture is the rearing of aquatic organisms under controlled or semi-controlled conditions and could be in saline or freshwater (FAO, 2004). While in many circles aquaculture is narrowly equated with recently developed intensive culture of shrimp and high value fish such as salmon (Kruska et al. 2003), it has a long history and was an ancient practice in some countries like China. Records of inland aquaculture in China date back 2,400 years. Marine fish and shellfish were farmed slightly more recently, dating back 1,700-2,000 years. "Fan Li on Pisciculture" is the earliest existing work in China on fish farming. It is also the first written work in the world on fish farming and sums up the rich experience of raising carp in ponds in the 5th century B.C. (Shuping, 2005). In Europe the origins of aquaculture go back approximately 2000 years to the Greek and Roman Empires (Bush, 2004).

Aquaculture systems may be land or water-based (Edwards, 1999b), i) land based systems involving ponds and rice fields can be integrated with agriculture ii) water-based systems involve lakes, rivers or bays through installation of cages, pens or other structures to provide support such as stakes, lines, or rafts for cultured organisms.

Aquaculture may be classified as extensive, semi-intensive and intensive according to the intensity of control, inputs used and productivity (FAO, 2004a; Muir 2005). FAO (2004a) simply defined these three systems as; i) extensive aquaculture does not involve feeding the culture organism, ii) semi-intensive aquaculture involves stimulating the growth of natural feeds through fertilization and supplementary feeding and iii) intensive aquaculture is which production is based on entirely artificial feeding. Muir (2005) defined extensive systems as close to natural fisheries requiring minimal inputs and offering low yields (100-300 kg/ha/year) and intensive systems require a large amount of inputs to maintain artificial culture environment with high yields (10-200kg/m³/year). However, between these extremes there are various degrees of semi-intensive aquaculture where definitions are less distinct (Muir, 1995).

Over the last three decades, aquaculture has been expanded, diversified, intensified and advanced technologically (Pillay, 2001). As a result, dynamic aquaculture has been developed to become the fastest growing food-producing sector in the world and has significantly contributed to world food security (Jia et al. 2001). World aquaculture production in 2000 was 39.4 million t, which has increased at 11% per year since 1984. In comparison, terrestrial farm animal meat production increased at 3.1% (Tacon, 2001). Table 1.3 shows the world aquaculture and fisheries production during 2000-2005 (FAO, 2006a) .

Table 1.3: World fish production and utilization trend

Production (million t)	2000	2001	2002	2003	2004	2005
Inland						
Capture	8.8	8.9	8.8	9.0	9.2	9.6
Aquaculture	21.2	22.5	23.9	25.4	27.2	28.9
Total inland	30.0	31.4	32.7	34.4	36.4	38.5
Marine						
Capture	86.8	84.2	84.5	81.5	85.8	84.2
Aquaculture	14.3	15.4	16.5	17.3	18.3	18.9
Marine total	101.1	99.6	101.0	98.8	104.1	103.1
Total capture	95.6	93.1	93.3	83.3	90.5	93.8
Total aquaculture	35.5	37.9	40.4	42.7	45.5	47.8
Total world fisheries	131.1	131.0	133.7	133.2	140.5	141.6
Utilization (t)						
Human consumption	96.9	99.7	100.2	102.7	105.6	107.2
Non-food use	34.2	31.3	33.5	30.5	34.8	34.4
Per capita food fish supply (kg)	16.0	16.2	16.1	16.3	16.6	16.6

(Source: FAO, 2006a)

Although per capita fish consumption (excluding farmed aquatic plants) has increased gradually, the availability of food fish from capture fisheries has declined over the years (Tacon, 2001). World aquaculture (food fish and aquatic plants) has grown significantly from a production of below one million tonnes in the early 1950s, production in 2004 was reported to have risen to 59.4 million tonnes, with a value of US\$ 70.3 billion (FAO, 2006b). The contribution of aquaculture to global supplies of fish, crustacea, molluscs and other aquatic animals continues to grow, increasing from

3.9 % of total production by weight in 1970 to 27.1 % in 2000 and 32.4 % in 2004 (FAO, 2006a). Aquaculture continues to grow more rapidly than all other animal food-producing sectors.

Worldwide, the sector has grown at an average rate of 8.8 percent per year since 1970, compared with only 1.2 % for capture fisheries and 2.8 % for terrestrial farmed meat production systems over the same period (FAO 2006a). Production from aquaculture has greatly outpaced population growth, with per capita supply from aquaculture increasing from 0.7 kg in 1970 to 7.1 kg in 2004, representing an average annual growth rate of 7.1 %.

Asia however, dominates global aquaculture production. In 2004, countries in the Asia and the Pacific region accounted for more than 90% of the total global aquaculture production in quantity and 80 % of the value (ARD, 2006; FAO, 2006a). Aquaculture production in Asia was 32.63 million t in 1997, which has increased from 13.4 million t in 1988 (Kongkeo, 2001). China is the largest producer in the world and contributes above 60% of the total world aquaculture production. South Asia produced 2.33 million t in 1997. However, but projections suggest that it will require another 7.8 million metric t of fish to feed 1720 million people in 2020, of which 97% is expected to come from aquaculture. Although Bangladesh ranks seventh in global aquaculture production, there is still a wide gap between local demand and supply of fish for the growing population (Kongkeo, 2001).

World aquaculture, in the recent past, has observed wide diversity within the sector. This is not only in technologies and farming systems employed, but also in national objectives and policies for aquaculture development in different countries, whereby priorities have been placed by governments and its growth has been supported (Kongkeo, 2001). Like many developing Asian and African countries, the Bangladesh government has adopted aquaculture development as a strategy for reduction of poverty and food insecurity in her 15 year poverty reduction plan, termed as “Poverty

Reduction Strategy Papers” (PRSP) (DoF, 2005). Despite the potential of aquaculture and fisheries and policy development, there is a large gap between demand and supply (Dey, 2000) and per capita fish consumption stands at 15 kg in 2004 (DoF, 2005). The consumption gap between poor and rich people has also been widening with the increase of population and liberalisation of the domestic economy and markets (Barman, 2000).

During the last two decades, a number of development projects had been implemented by the Government’s Department of Fisheries (DoF), donor agencies and national and international non-government organisations (NGOs) individually or in collaboration. Almost all key donors in the agricultural sector have supported aquaculture development with different projects through financial and technical interventions. National and international NGOs have played a key role in implementing those development projects and disseminating the aquaculture technologies (Islam, 2002). Twelve exotic species have been introduced to the country and some of those have become very significant in production, such as silver carp (*Hypophthalmichthys molitrix*). This contributed an estimated 23% of total fishpond production in 2001, and consumption, particularly for poor people (Islam, 2002; DoF, 2005). As a result of combined efforts, a variety of noble aquaculture interventions and enterprises have been developed and tested, such as “rice-fish farming”, cage aquaculture and integrated shrimp and prawn farming, and pen aquaculture at different locations targeting different resources. At the same time conventional pond aquaculture has been improved, diversified and integrated with other agricultural commodities (ADB, 2005). The overview of the broad based aquaculture systems practiced in Bangladesh is outlined below;

1.1.4.1 Conventional aquaculture in Bangladesh

Conventional aquaculture in Bangladesh is based on polyculture of fish mainly Indian major carps, Chinese carps and common carp in ponds and ditches. Small-scale

aquaculture (mainly homestead ponds) produced 700,000 t of fish in 2002, which is about 80% of the total fish produced from aquaculture in Bangladesh and the other 20% were from commercial fish ponds, cages and integrated rice-fish system (ADB, 2005). There are an estimated 1.3 million fish ponds in the country, covering an area of 0.151 million ha, of which 55% is cultured, 29% has good potential for culture and 16% is currently unused, but which could potentially also be brought under fish culture. In 2002 the percentage of production from the above three systems was 72%, 20% and 8% respectively (BBS, 2002). Over the last decade aquaculture production in Bangladesh has grown by 20% per annum (Muir, 2003).

In the past, fish farming was extensive and pre-dominantly involved stocking of ponds with wild caught fish seed from rivers with little subsequent management or use of feed and fertilizer. However, following the introduction of the technology of induced spawning of carp, coupled with improved and semi-intensive fish-pond management since 1980s, fish farming became more widespread and gained significant increases in productivity. The majority of fish ponds were originally constructed as borrow pits for taking soil to build homestead settlements, houses and, roads and pathways (ADB, 2005). While ponds are used for multiple purposes, like bathing of humans and cattle, washing clothes and utensils etc., the primary aim of aquaculture is to increase household fish consumption and income. Conventional systems are mostly extensive or semi-intensive, which involve low levels of input and management and lower yields.

Fish culture follows a seasonal pattern. Fish farmers stock fingerlings in their ponds and ditches in the early rainy season (May – June) when there is enough water in ponds. They purchase fingerlings (3-5 inch in length) from either fingerling vendors or fingerling nurseries (Karim et al. 2004). The stocking rate and proportion of different fish species, varies widely among individual farmers depending upon the farmer's own objectives, preferences and strategy, and in many cases, farmer's ability to invest (Karim, 2006; Bunting, 2006). Most farmers prefer polyculture of fish based

Indian major carps, Chinese carp and common carp. In the Mymensingh region, fish is grown for 9-11 months. Fish is grown mainly on natural foods in the water, which are enhanced by the regular application of livestock and poultry manure as well as inorganic fertilizers like urea and triple super phosphate. In addition, in the semi-intensive production system, farmers supply rice bran, wheat, oil cake as supplementary feed (DoF, 2002), of which rice bran is the main supplementary feed for fish in pond aquaculture (Karim, 2006).

Fish farmers often thin out fish in small quantities for home consumption (AIT-NFEP, 1999). They also sell fish when they require. Finally, in the winter (November-January) farmers sell all or most of the remaining fish (only keeping small-size fish if water is available). (DoF, 2005). Fish yield varies in different areas of Bangladesh due to intensity of management and level of input use as well as quality of natural resources and climate (CARE, 2001; Islam, 2002). Karim (2006) found that the mean production of fish in Mymensingh was 2060 kg/ha/year while (DANIDA, 2004) found the production was 3300 kg/ha/year. Average fish production was much lower in the northwest of Bangladesh at 1601kg/ha (CARE 2001; Islam, 2002).

There is no significant adverse environmental impact from conventional semi-intensive polyculture of carps in ponds (ADB, 2005). The aim of conventional aquaculture has been shifting towards more commercial production as the demand and price of fish has been increasing with the growth of population. Small-scale farms have also been able to increase production by intensifying management and input use. While a more intensive type of farming has emerged in some parts of the country, like the Dhaka-Mymensingh corridor mainly with catfish pangus (*Pangasius hypophthalmus*) farming. Many small-scale farms have also intensified production by increasing inputs as well as integrating with agriculture, particularly with vegetables and rice (ADB, 2005; Karim, 2006).

The contribution of pond aquaculture is significant to households in terms of fish consumption and income (Bouis, 2000; ADB, 2005). The improvement of production technologies certainly increased yield and income from pond aquaculture and benefited farming households. However, the broader impact of pond aquaculture to rural livelihoods, particularly the people involved directly or indirectly in the production managements is not well understood.

1.1.4.2 Rice-fish farming in Bangladesh

Rice-fish farming is an age old practice in many Asian countries. Deliberate stocking of fish seed in rice-fields and its management in Bangladesh, was introduced and promoted during the 1980-90s by the research and development agencies (DoF, 2002; ADB, 2005; Gupta et al. 2002). Rice is the staple food of the country's people and is cultured in suitable part of the country. Therefore, integrating fish with rice cultivation has a enormous potential in the country (Barman, 2000; Barman and Little, 2006) . Fish in this system are mostly considered as an incremental benefit with little marginal investment cost. Rice-fish farming constituted 0.3% of the total national aquaculture production in 2002 (Alamgir et al. 2003).

Fish can be grown concurrently or alternatively with rice. Alternative culture is usually practiced in the southern region of Bangladesh where water levels are high in the monsoon and not feasible for growing rice (CARE, 2001). The concurrent system is most popular in the north-west region, which is an important rice growing area of the country. Fish are grown in both irrigated and rain fed rice in this area. Farmers mainly grow fish seed with the irrigated rice (*boro* season) and table fish with the rain fed rice (*amon* season). Rice fields need to be altered by raising dikes to prevent flooding and escape of fish and digging refuge for fish during water shortage. Usually rice fields are rich with diverse natural fish food organisms, requiring little or no supplementary feed. Farmers usually grow fingerlings, mostly common carp (*Cyprinus caprio*) in irrigated rice fields, while raising tilapia (*Oreochromis niloticus*)

fingerlings is becoming popular for the rice-fish farmers in northwest Bangladesh (Barman et al. 2002). The rain fed *amon* (rain fed varieties of rice), season rice fields are stocked with a variety of carp species like rohu (*Labeo rohita*), mrigal (*Chrrihinus mrigala*), catla (*Catla catla*), and slivercarp along with silverbarb (*Barbodes gonionotus*) as the main species (Gupta et al. 2002). Fish is cultured for about 3 months and harvested when the water level becomes inadequate. However, fish from rice-fish system is consumed as required by the households; even if fish are small in size (AIT-NFEP 1999). The average production of fish in the rice-fish systems was 184 kg/ha in irrigated rice and 233 kg/ha in rain fed rice. Gupta (2002) found the fish production in the field. Although the fish production level is low (for different seasons compared to pond production), the results and benefits shows a promising potential for increasing fish production and household nutrition (Barman, 2000; Barman and Little, 2006; Haque et al. 2006). Through proper technology dissemination approaches an estimated 65,000 ha rice field could be brought under an integrated rice-fish system (Dewan, 1992).

1.1.4.3 Prawn and shrimp farming

Introduction and widespread dissemination of brackish water shrimp and freshwater prawn farming in Bangladesh is revolutionary in the history of aquaculture (Ahmed, 2001). This high value product is mostly exported and contributed 5.7% of the total national export earnings in 2004 (DoF, 2005). Shrimp cultured are marine species: there are 36 marine shrimp species in Bangladesh and among those *Penaeus monodon*, which is commonly know as Black Tiger shrimp and locally called *bagda chingri* and is widely cultured along the coastal zone (FAO, 1980; Arrigonon et al. 2004; DoF, 2005). On the other hand, the term prawn refers to freshwater prawn in Bangladesh and there are 24 freshwater prawn species in the country. The species *Macrobrachium rosenbergii* is the fastest growing among *Macrobrachium* species and therefore most widely cultured in freshwater (Brown, 1991; Nuruzzaman, 1993). This species is known as the giant river/freshwater prawn worldwide, while in

Bangladesh it is commonly known as '*golda chingri*' (FAO, 1980; Holthuis, 1980; Hussain, 1994; New, 1995).

In Bangladesh, freshwater prawn farming first started in the south-western region in the 1970s (Mazid, 1994; Aftabuzzaman, 1996). Locals learnt to catch prawn fry from coastal rivers and reared them in ponds (Ahmed, 2001). In the late 1980s, farming began to be adopted widely around Bagherhat, in which freshwater prawns were grown along with carp, rice and other crops. The expansion of freshwater prawn cultivation has been dramatic, and during the 1990s adoption has accelerated, spreading to other southern districts such as Barisal, Khulna, Shatkhira and Jessore (Kamp, 1994). In 2005, there were 1.15 million shrimp and prawn farmers in the country covering an area of 203,071 ha in total of which three-quarters were in the south-western region and the rest in the south-eastern region (Khatun, 2004; DoF, 2005).

Freshwater prawn is cultured in low lying modified rice fields locally called "*gher*", an approach which has been genuinely developed by farmers (BOBP, 1990; Rosenberry, 1992; Rutherford, 1994; Fleming, 2004). Rice field dikes are raised above normal flood level and a canal of 3-5 feet deep and 10-20 feet wide is excavated inside the periphery as a refuge for prawns and fish during the dry season (Kendrick, 1994). The rice land in the middle is retained and locally called *chatal*. The early *gher* innovators tended to be large and middle size farmers, but outcomes attracted small-scale farmers to develop *ghers* and the number of small-scale *gher* farmers has been increasing rapidly beyond the costal region including greater Jessore district (Rutherford, 1994). The majority of these small-scale farmers are quite poor. Although *ghers* are built for growing prawn, it is practically an intensive integrated system of prawn, fish and agriculture (DFID, 1997). In *gher* systems, prawn is raised with polyculture of fish in the rainy season, throughout the whole *gher* and rice is grown in the dry season in the *chatal*, and vegetable and fruits are grown on the dikes round the year (Ahmed, 2001).

These small-scale aquaculture systems are predominantly household based activities and management of these production systems involve household members. Household labour division shows women (housewives) are actively involved in agricultural production and spend a significant proportion of time in agricultural activities which include aquaculture for fish farming households (Menon, 2000).

1.1.5 Women in aquaculture

In the male dominated Bangladeshi society, traditionally rural women are restricted within households by socio-cultural and religious boundaries commonly termed as “*purdha*” and are expected to remain within the homestead (Jahan, 1995; Amin, 1997). Women are primarily responsible for all household activities, which include child care, cooking, washing, cleaning, collecting of cooking fuel etc. In addition, however, women are traditionally involved in a variety of agricultural activities that do not require them to move outside of homestead (Hamid and Alauddin, 1998; Shelly and Costa, Undated). These activities include poultry and livestock rearing, homestead vegetable gardening, grain and seed processing and storage etc. These productive activities are often considered additional to their domestic above household activities. However, nowadays, as a result of the changing social context and several NGO initiatives women are getting increasingly involved in income generating activities (Ali and Niehof, 2005).

Involvement of women directly and indirectly in fisheries and aquaculture is an age old practice in many Asian and African countries. Women perform a range of activities throughout the value chain of aquatic food products (Kevane and Wydick, 1999; Shaleesha and Stanley, 2000). These activities includes fry collection from nature, induced breeding in hatcheries, grow-out production and management, on-farm and on shore post-harvest activities, marketing of products and processing of fisheries products (Sharma, 2003; Song, 1999). In Bangladesh, women are also involved in many fisheries and aquaculture activities. Women in marine fishing

communities are involved in several post-harvest activities such as fish sorting, washing, drying packaging etc. A large number of women are also employed in prawn processing. Rural women are also reported to be involved in small-scale aquaculture (Barman et al. 2002; Islam, 2007). Shelly (2005) notes that with the changing socio-cultural condition women's participation in agricultural production systems in Bangladesh has started to shift from household based farming activities to labour intensive farming systems. In addition, many NGO initiatives promoted group based pond management and community based fisheries management (Sultana et al. 2001). However, their contribution, benefits both the household and national economy is still largely invisible or ignored. Since a rural woman's work outside her household is often unpaid, it is therefore rarely accounted in official statistics (APC, 2006).

Therefore, it is important to understand and recognize the impacts of aquaculture at the household level as well as on the broader rural livelihoods (Ahmed, 2001; Stonich and Bailey, 2000; Hall, 2004). However, benefits from different aquaculture production systems critically depend on the national and international demand for the products and access to markets, particularly for poor producers (Ahmed, 2001; Muir, 2005b). A review of the literature suggests that the marketing of aquaculture products is gaining importance in the development arena and should be given more emphasis in the future if the benefits from aquaculture are to be sustained (Squires et al. 1998; Khatun, 2004). To understand and address poverty it is essential to examine the economic and social context, including institutions, markets, communities and households (Khan, 2001).

1.1.6 Marketing of aquatic products in Bangladesh

In broader aspects marketing is the process of planning and executing the conception, pricing, promotion, and distribution of ideas, goods, services, organizations, and events to create and maintain relationships that will satisfy individual and organizational objectives (Boone and Kurtz, 1998). The American Marketing

Association defined marketing as “an organizational function and a set of processes for creating, communicating and delivering value to customers and for managing customer relationships in ways that benefit the organization and its stakeholders” (AMA, 2004).

Markets and marketing are critical mediating institutions in rural livelihoods for over all development. Markets, when they work, can be an efficient mechanism for the exchange of goods and services, the coordination of buyers and sellers and the allocation of resources in an economy (DFID, 2006). Marketing of aquatic products in Bangladesh is playing an important role in the exchange and flows of products from producers to consumers. Fish marketing in Bangladesh has been mostly developed and driven by the private sector, which is also observed in other south-east Asian countries like India, Thailand and the Philippines (FAO, 2001a). Marketing of aquatic products in Bangladesh is inherently complex due to the existence of different type of markets, distribution channels, channel intermediaries, contracts and heterogeneous consumers (Alam, 2001). Different type of aquatic products from different sources is channelled in different ways to the domestic and international markets. Marketing of aquatic products can be broadly characterised as domestic marketing and export marketing.

1.1.6.1 Domestic fish marketing:

Almost all fishes (95%) produced in the country are consumed locally (DoF, 2005). Fish from different sources (culture, capture and marine) are distributed to the consumers throughout the country by channel intermediaries. Although all sorts of fish for consumption may be sold side by side at the same time and with in the same retail market to consumers, the marketing and distribution channels of fish from culture, capture, and marine fisheries vary to some extent. The domestic fish marketing chain is commonly described as long passing through 4-5 intermediaries (Dey, 2000; Muzaffar and Helaluddin, 2001). Lack of awareness and information on

demand and supply together with poor communication facilities, as well as limited human capital of fishers and farmers allow channel intermediaries to be more involved in marketing (Alam, 2001).

Fish from the freshwater capture fisheries are distributed through the landing ports or *arots* (auction house). Fishers, who catch fish from fishing grounds or rivers in different areas sell their catch to middlemen (locally called *nikari*) through bargaining. A common complaint is that price fixing among the *nikaris* leads the fishers to be exploited with low prices of their catch (FAO, 2001a). *Nikari* then sell the fish to *arots* at landing ports, from which fish are distributed to different auction markets and then to urban and rural retail markets. All marine fish, caught by private boats or trawlers are landed at ports. The Bangladesh Fisheries Development Corporation has built five landing ports mostly in the southern part of the country (DoF, 2004). Marine fish are sold through auction to distributors, who then transport to urban auction markets. From there they are transport to urban and rural retail markets.

Traditionally fish farmers sell their fish to middlemen or harvesting teams at the farm gate (FAO, 2001a; Muzaffar and Helaluddin, 2001), but with increased awareness farmers also increasingly sell their fish directly to retail markets or *arots*. *Arottdars* (auctioneers) organise open bidding for farmers and take commission at about 8-10% from farmers (in some parts both from farmers and retailers). The auction system provides a competitive price for farmers (FAO, 2001a). If not auctioned at fish are often sold fixing a price through bargaining at rural markets.

A farmers' or fisher's role is normally over after the selling of products to intermediaries. Then, in the course of channelling and distributing fish from producers to consumers, marketing intermediaries play an important role and carry out a range of functions at different levels, which covers handling, cleaning, sorting, icing, preservation and transportation (Muzaffar and Helaluddin, 2001; Pokhrel and Thapa,

2006). However, despite their marketing services, marketing intermediaries are often viewed as exploitative taking away a large share of the benefit accrued from the sale of fish by taking advantage of small farmers' unawareness of market prices (Ellis, 1996). Auction markets are playing an important centre of stakeholders and providing several services to them, which include farmers' loan from auctioneers, retailers take fish from auctioneers on credit and information of aquaculture inputs.

The market infrastructures and facilities are commonly described as poor and inadequate (Sarker et al. 2006). The urban auction markets constructed by the municipal corporations have some facilities like drainage water supply, ice supply, while most rural markets are lacking these minimum facilities and rarely meet the needs of market users. FAO (2001b) classified domestic fish markets of Bangladesh into 4 categories: i) Primary markets: markets in villages and close to the fish landing places for captured fish, are considered as primary markets. Although fish can be sold directly to consumers at primary markets, most of the captured fish are channelled to secondary markets. ii) Secondary markets: In secondary markets fish are gathered from different sources including primary markets and distributed assembled (sorted, graded, weighed and packaged) mainly to urban markets. Usually thana (Sub districts) and small district markets are considered as secondary markets, iii) Higher secondary markets: These type of markets usually consists of several wholesale markets or centres. Big city auction (wholesale) markets are considered as higher secondary markets, and vi) Terminal markets: The retail markets are considered as terminal markets. There are two types of retail markets; *bazaar* (which operates daily) and *hat* (operates twice weekly) (CARE, 2001). Piumsombun (Undated) notes similar classification for fish markets in Thailand into 3 categories as i) Primary fish markets, ii) intermediate markets, iii) Terminal markets. Due to poor communication and infrastructure farmers from remote areas can not access town markets (Ahmed et al. 2005).

1.1.6.2 Export marketing

Export of non-traditional products, like fisheries products, has been boosted remarkably since the 1990s due to policy reform on trade liberalisation and trade promotion as well as integrating local economy with the global economy. The policy reforms in late the 1908's and early 1990s included stimulating exports and encouraging investment in export-oriented interventions through removal of anti-export bias, introduction of incentives for exports and facilitation of participation in global market (Khatun, 2004; Ittefaq, 2005).

Shrimp and prawn dominates fisheries export marketing and only small quantities of frozen freshwater and marine finfish are exported (DOF, 2005). Almost all shrimp (*bagda*) and prawn (*golda*) produced both from culture and capture fisheries in Bangladesh are exported after processing. There are 124 processing factories in Bangladesh sited mostly in Khulna and Chittagong (Bayes et al. 2005; DoF, 2005). All these factories are private owned and are independent companies. The marketing chain within the country is completely separated from domestic fish marketing and the products flow from farm to processing factories. The processing factories do not buy prawn and shrimp directly from producers mainly because of their small quantities as well the factories being established in cities. Therefore, prawns are channelled from production point to processing factories through different level of intermediaries (Bayes et al. 2005). However, the marketing channel for captured shrimp and prawn operated in different channel.

Khatun (2004) reported that in the coastal region of Khulna farmers sell most of their prawn to local collectors called "*foira*" (middlemen). The *foira* then transport prawn and shrimp to the urban depots which are mostly situated near the factories. At the depots, some pre-processing activities such as washing heading, icing and packaging are carried out before it goes to the factories for final processing. But the processing factories are responsible for the final sorting, grading, icing and packing as well as export. Many farmers with little investment capital for farming borrow money from

depots through the *foiras* and are then compelled to sell prawn to that particular *foirs/depos* at slightly lower rates than current market prices (Khatun, 2004). A similar case is found is for depot owners, who take loans from processing factories. This highlights the shortage of business capital and issues of access to credit in this marketing chains.

In the case of wild shrimp the supply chain is slightly different. Fishing is generally performed by trawlers, mechanised and non-mechanised boats. The trawlers make a trip for 25-30 days at a time and the trawlers have the processing and preservation facilities on-board. Therefore, the trawlers go for fishing with a crew of 20-25 which include fishermen, processing workers and other labourers and most processing takes place at sea. Once landed, the shrimps are then supplied to the buyers, and depot owners. They are then sold to processing factories.

As many activities (handling, sorting, grading, icing and packing) take place in the marketing before export quality control is a concern, particularly after the import ban of shrimp and prawn by the European Union in 1997 due to a failure to meet the quality standard (Rahman, 2001). Though the ban lasted for only 6 months, it has left behind quality control as a major concern both for exporters and channel intermediaries as well as government.

The shrimp industry in Bangladesh generates employment for an estimated 600,000 people, which includes poor producers and channel intermediaries (Bayes et al. 2005). They estimate that with an average family size of 5.6, about 3.4 million people of Bangladesh are, directly or indirectly, dependent on this industry for a living. Khatun (2004) notes that among the channel intermediaries fry collectors, hatchery workers, depot workers, processing workers and transport workers are the poorest in the society and deprived from many basic needs. While the employment in marketing is critical for survival, the impact of the employments in broader livelihoods and welfare is largely under studied.

1.1.7 Poverty reduction and Sustainable Rural livelihoods

Poverty is a multifaceted concept. Traditionally poverty is viewed as pronounced deprivation in well-being (Hossain, 2004a). Poverty is usually measured with reference to a threshold level of income or expenditure, termed as the poverty line, to meet food and non-food basic needs for a person to maintain healthy and productive life. The United Nations defined the “poverty line” as and “individual with an income level that is considered minimum sufficient to sustain a family in terms of food, housing, clothing, medical needs, and so on (United Nations, 2006). Since the publication of Sen’s theory of entitlement (Sen, 1981) a ‘new consensus’ in development economics has emerged over poverty reduction, in which human capital provision, rapid economic growth (focusing on labour-intensive sectors) and the provision of ‘social safety nets’ are seen as being essential (Zheng, 2000). In contrast to the narrow definition of poverty retained within the new consensus, the literature suggests that broader measures of well-being, which recognize entitlements (Sen, 1981), vulnerability (Chambers, 1989) and empowerment (Friedmann, 1996) are necessary to represent the nature of poverty more accurately (Williams, 1999; Anderson, 2003). Sen (1993) later, defined poverty as “capability deprivation”, which refers to non-income dimensions of poverty and focuses on unmet basic needs in food, clothing , housing health and education.

Analysing livelihoods is increasingly gaining interest as a “new” approach in research and development to address rural poverty reduction, particularly in developing countries. This is perhaps because increased awareness of livelihoods can lead to better formulated policies than those based on conventional sector and sub-sector analysis (Stroud, 1996).

Livelihoods can be defined as “a means of living”, which refers to the way of living rather than income and consumption alone (Stroud, 1996; Avnimelech, 1998; Chambers and Conway, 1992). Avnimelech (1998) also defined livelihood as “comprise of the capabilities, assets (stores, resources claims, and access) and

activities required for a means of living”. Afterwards, several researchers used this definition with minor modification (Carswell, 1997; Scoones, 1998). This definition highlights the linkage between assets and the activities determined by those assets that can generate income for survival. Slightly modifying Chambers and Conway (1992) definition, Ellis (2000a) defined livelihoods as “a livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household.

Taken together, these definitions reveal that livelihoods are a multi-faceted concept, being both what people do and what they accomplish by doing it, referring to outcomes as well as activities. Niehof and Price (2001) define livelihoods in terms of a system, which can be conceptualised as having the following components:

- i. Inputs: resources and assets
- ii. Output: livelihoods
- iii. Purpose: livelihood adequacy for meeting basic needs (Chambers, 1989)
- iv. Activities: livelihood generation and the composition of the livelihood portfolio
- v. Agency: efforts of households and individuals to achieve livelihood adequacy
- vi. Quality: degree of vulnerability (or sustainability) of the livelihood produced
- vii. Environment: context within which the livelihood system functions interfaces with other systems and institutions

Many development agencies have adopted the livelihood concept as central to their development strategies and activities with further minor modifications (Gupta, 1992). According to the Department of International Development (DFID) “a livelihood

comprises the capabilities, assets and activities required for a means of living. A livelihood is considered as sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both at present and in the future, while not undermining the natural resource base (DFID, 2000). Gupta (1992) placed emphasises four key dimensions to sustainability – economic, institutional, social and environmental sustainability. All these are important, but a balance must be found between them. While USAID (Undated) defined livelihood as the sum of ways in which people make a living. In most communities in low-income countries, poor families balance a set of food and income-earning activities. Acute food insecurity results when the failure of one or more of these strategies cannot be compensated for other strategies. Livelihoods are studied and analysed because these provide holistic information that can reveal how, and why, people survive (or fail to survive) difficult times as to reduce vulnerability.

1.1.7.1 Vulnerability and Livelihood diversification

Vulnerability refers to the full range of factors that place people at risk of becoming food insecure. The degree of vulnerability for an individual, household or a community is determined by their exposure to the risk factors and their ability to cope with stressful situations (Varadi et al. 2001). Vulnerability is defined as a high degree of exposure to risk, shocks and stresses; and proneness to food insecurity (Chambers, 1989; Bhuiyan, 1999). There are two aspects of vulnerability; external threat to livelihood security such as climate, sudden disaster and internal; coping capabilities by assets, food stores or support from kin and community. Households, that are both highly prone to adverse external factors and lacking in asset or social support systems are most vulnerable in the society (Stroud, 1996)

Devereux (2001) noted vulnerability is a concept that combines exposure to a threat to susceptibility or sensitivity to its adverse consequences. Although poverty and vulnerability are not synonymous, the poor are more prone to livelihood threats

(Wisner, 1993) and are more susceptible to shocks due to their low level of asset holdings. The rural poor are always particularly exposed and especially vulnerable to livelihood shocks and variability.

Livelihood insecurity is not just a symptom of poverty, rather it is contributory. Sustainable rural livelihood development therefore requires tackling vulnerability as well as reducing poverty since vulnerability is correlated with poverty. Vulnerability and sustainability, though not antonyms, represent the two extremes of a continuum indicating the quality of the livelihood system.

Niehof (2004) noted sustainability is usually defined as the ability to cope with and recover from stress and shock, while maintaining or enhancing capabilities and assets (Avnimelech, 1998; Scoones, 1998). Households with vulnerable livelihood systems have neither enough assets, nor the capabilities to create or access them. Such households have problems in providing for their members' basic needs, are unable to create a surplus, cannot cope with a crisis, and are often chronically in debt. They are often burdened with liabilities, such as having unhealthy members or living in a degraded or hazardous environment, rather than having assets. Niehof (2004) suggests that sustainable livelihood systems have a sufficiently robust and stable base of assets and resources. Even in a situation of crisis or stress, such households will be able to recover and bounce back.

To reduce livelihood vulnerability, livelihood diversification is the common phenomenon and important strategy for many developing countries (Niehof, 2004). Over the years, rural poor people in developing countries adopt several strategies to spread risks for smoothing food consumption and income during such crisis or stress. According to Stroud (1996) rural livelihood diversification is defined as the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living". Barrett et al. (2001) noted: "diversification is widely understood as a form of self-insurance"

spreading of risks has long been associated with poverty and survival. However, diversification is not just associated only with survival, it may be related with success at achieving livelihood security under improving economic conditions as well as with livelihood distress in deteriorating conditions” (Ellis, 1998).

Ellis (2002) argued diversification could be one of two types by “necessity” or “choice”. Necessity refers to involuntary and desperate reasons for diversifying livelihoods, while choice by contrast, refers to voluntary and proactive reasons for diversification. In the rural development context, diversification is often viewed as either on-farm changes in mixed agricultural activities or developing rural-based non-farm full time employment. Diversification, however, in both cases is considered as changing full-time occupation rather than as a single individual or family/household possessing multiple occupation (Pullin, 2001). Scoones (1998) identified three types of rural livelihood strategies: agricultural intensification or extensification, livelihood diversification including both paid employment and rural enterprises, and migration (including income generation and remittances). Batliwala (2003) lists these categories of livelihood strategies as natural resource based, non-natural resource based and migration (Stroud, 1996), in contrast, in his framework, categorises livelihood strategies as natural resource based activities or non-natural resource based activities (including remittances and other transfers).

Growth in livelihoods is considered as essential for reducing vulnerability or poverty through diversifying livelihoods in both natural resource based (on-farm and off-farm) and non-natural resource based (non-farm). On-farm and off-farm growth increases food for consumption and incomes, and demand for labour (employment), while non-farm growth increase jobs and services in agriculture and value chain both forwards and backward linkages.

However, sustainable diversification focuses more on the non-economic attributes of survival, not only economic ones, which therefore includes “inter alias” the social

relationships and institutions that mediate people's access to different assets and incomes (Stroud, 1996). This is described as “livelihood processes” and “transforming processes” in the livelihood framework. In broader terms transforming processes includes policies, institutions, law, incentives (relative price), and social relations and seek a great number of contextual, trend and condition, considerations for reducing vulnerability. ‘Social relations’ as transforming processes are sometimes viewed together under ‘institutions’. According to Stroud (1996) social relations refer to the social positioning of individuals and households within society, which comprises gender, caste, and class, religion, age etc. On the other hand, institutions are the formal rules, conventions, and informal codes of behaviour, that comprise constraints of human interactions such as laws, land tenure arrangements (property rights), and the way markets work in practice (market as an institution). Markets (as institutions) and social relations together are critical mediating factors for livelihoods as they encompass the agencies that provide support or restrict the capabilities of individuals or households (Stroud, 1996).

1.1.7.2 Livelihoods and markets

Markets provide an important mechanism for efficient coordinated economic exchange, and the volume of transaction indicates the economic condition of a society or country (Dorward and Kydd, 2005). An increasing trend of volume of market transactions is a key feature of richer economies. Promoting more efficient and extensive markets and promoting greater access to exchange mechanism for the poor is an important element for livelihoods development. The theoretical economics literature often relate vulnerability to market failures such as asset markets, capital markets, and labour markets and economists see improving rural livelihood sustainability to removal of market inefficiencies (Devereux, 2001).

DFID (Undated) noted that agricultural growth in poor rural areas can contribute poverty reduction through three broad ways: i) by directly increasing income for

farmers and farm labourers through increasing agricultural productivity, ii) supplying food for both the urban and rural poor; and iii) agriculture's contribution to growth and the generation of economic opportunity in the non-farm sector. Over time this leads to structural economic change, with growing importance of the non-farm economy. While agricultural growth has its greatest impacts on very poor rural economies, it can face severe challenges such as demanding supply chains, weak institutions and often thin markets (less demand and preferred buyers for products), and these can lead to low level equilibrium traps which discourage smallholder farmer and agri-business investments. In such circumstances the development and operation of institutional mechanisms promoting coordinated exchange along supply chains and the access of the poor to such exchange becomes critical to pro-poor growth in rural areas.

Dorward et al. (2003) noted 'sustainable livelihoods and poverty reduction has to be related to wider dynamic processes of growth of local and national economics, to the two-edged sword of competition, both a force for increasing economic efficiency with lower price for consumers, and a threat to particular stakeholders (poor intermediaries). Perhaps the most important point is that development of livelihoods critically depends upon, among those things, demand for the outputs (goods and service) supplied by those livelihoods. If the roles of market and market relationships are not properly addressed in livelihoods analysis and action, then it can lead to failure to identify and act on (a) livelihood opportunities and constraints arising from critical market processes and (b) institutional issues that are important for pro-poor market development (Dorward et al. 2003).

The livelihoods of most rural people are directly or indirectly dependent on their involvement in a range of markets as private agents or as employees. Therefore, growth of markets can provide a highly efficient mechanism for exchange, coordination and allocation of many resources, goods and services. However, poor rural poor people themselves often find problems which are critical to their

livelihoods. This may be because of their low level of human capital and social networks. Therefore, the current research aims to analyse the impact of production and marketing of aquaculture products on rural livelihoods using sustainable rural livelihoods framework.

1.1.8 Livelihood analysis: Approach of impact assessment

Livelihood approaches involve a conceptual shift from analyzing rural people as smallholder farmers to much a broader understanding (Murray, 2002). Several frameworks have been proposed for the analysis of livelihoods. They include the Sustainable Livelihood Framework (SLF) (Carney, 1998; Scoones, 1998), the Framework for Thinking about Diverse Rural Livelihoods (Ellis, 2000a), (Bebbington, 1999)'s Capitals and Capabilities Framework, and the (UNDP, 1999)'s Sustainable Livelihoods Diamond. These frameworks have different emphases rather than basic conceptual differences. They all attempt to integrate assets, constraints, and human capabilities in a logical and comprehensive manner to analyze the status, form, nature, and condition of livelihoods over space and time. Among these frameworks, the SLF has been the most popular partly because of its robust analytical ability and also because of its widespread promotion by development agencies. The SLF posits households make a living by using five types of assets (natural, physical, human, social, and financial) in an environment influenced by institutional and structural factors (Ellis, 2001). It identifies vulnerability as a key factor that households seek to manage.

The key features of the livelihood framework make it especially relevant for studying resettlement. The features are firstly, it views resettled households as making a living in a variety of ways of which farming may be just one (Francis, 2000; Murray, 2002). This liberates us from the "smallholder farmer" straightjacket that dominates rural development discourse. Secondly, livelihood approaches emphasize the need to see land as just one among several different assets/capitals required to make a living to

human, financial, physical economic infrastructure, and socio-political assets. Thirdly, livelihood approaches place the interaction of the various capitals within a broader policy environment. Fourthly, the framework allows us to investigate livelihood dynamics in a given geographical and historical context (Murray, 2002). Livelihoods are not static but change in response to various internal and external stimuli (Chimhowu and Hulme, 2006).

The livelihood framework is increasingly used in rural development, policy research and impact assessment. Furthermore the approach is positive in that it first identifies what people have rather than focussing on what people do not have (Cahn, Undated).

1.2 Rationale of the research

The general introduction highlights the theme ‘aquaculture for development’ more specifically, improvement of livelihoods by reducing poverty. While the potential of aquaculture can be widely recognised from the growth in recent past years, which suggests significant future dynamic growth and contribution to development of the country, this will not be automatically happened only by changing production technologies. A wide range of social and economical issues should be considered simultaneously associated with aquaculture, its development and interactions which are, in fact, closely linked to national, international policies and, institutional features (Muir, 2005). Although, many aquaculture technologies appear to have led to increased yields (Ali, 1996), the development of aquaculture, and the benefits derived, have faced criticism for the lack of clear impacts on the poor and, particularly, the belief that its promotion may further undermine the access of the poorest groups to fish (Bernacsek, 1991; Govereh et al. 1991; Ahmed, 1992b; Thompson et al. 2000; Ahmed, 1992a; Farrington, 1998). In many cases, the adoption of these technologies and broader impacts on rural livelihoods and benefits to the poorest people remain unclear. Clear understanding of current status of aquaculture as a whole and its impact

on livelihoods, particularly in the rural areas, would contribute significantly to effective development of future policy and efficient technologies (Edwards, 1999a).

The export of aquatic products (mainly shrimp and prawn) encouraged by the government to increase foreign exchange has led to a rapid expansion of the technology in many areas beyond the coastal zone over the last decade (Rahaman and Helal, 1996). While it is widely seen that introduction of shrimp farming in the coastal district of Bagherhat, Shatkhira and Khulna has enhanced the rural economy, the environmental and socio-economic implications have also been documented as significant (Primavera, 1997). The displacement of the traditional food production systems in coastal areas greatly increases risks to food security as well as encouraging greater dependence on cash transactions for the rural livelihoods (Ahmed, 2001; Panorama Acuicola, 2005). Similarly in Africa, fish consumption has been found to decline and socio-economic welfare became imbalanced due to the increasing trend towards export products (Bernacsek, 1991). Development of such export oriented aquaculture without understanding the broader impact on the rural social, economy and environment may lead to further livelihood deterioration, particularly for the poor rural people. Current study will analyse the impact of intensive export oriented prawn productions on rural livelihoods in recently expanded prawn farming areas.

Growth of aquaculture can enhance the rural economy directly and indirectly in many ways, beyond the producer household. Intensive aquaculture requires a relatively high input of labour, which makes them pro-poor (GFAR, 2006). In such cases employment opportunities for many poor households, like day labourers and fishers, may be enhanced. However, the level and condition of such employment, and impact on household and broader rural livelihoods are understudied. Therefore, (Hamid and Alauddin, 1998) raises concerns for the quality of thus employment as well as vulnerability related to global trading conditions (demand and supply). The current study will analyze the level of on-farm employment and its impacts on rural livelihoods.

Traditionally, women are involved in a variety of agricultural activities (Paul and Saadullah, 1991). Such involvement significantly increased over the last two decades through the government and NGO initiatives, particularly micro-credit programmes of NGOs (Islam, 2005). Many development projects in Bangladesh, particularly NGOs have involved women and encouraged participation in socially accepted aquaculture activities like feeding, fertilising, liming etc. The women cage farmers of CARE CAGES project managed cages jointly with their husbands (Menon, 2000). Furthermore, increased labour demand with intensification of aquaculture have affected intra-household labour allocation leading to an increased role of women in aquaculture (Weinberger and Genova, 2005). While, the division of labour showed that women's workload was often considerably increased (Brugere et al. 2001), the impacts of their involvement in aquaculture on individual and household level are unclear and poorly documented (Spring, 2001). A review on the impact of woman's participation in aquaculture and their benefits would help better define strategies to involve them in aquaculture; otherwise such involvement would end up only with increasing workload for women. The research will examine the roles of women in aquaculture and the impacts of their involvement within households.

The livelihoods of most rural people are directly or indirectly dependent on their involvement in a range of markets as business agents or as employees (Dorward et al. 2003b). Transaction of aquatic products has certainly increased both nationally and internationally with the growth of aquaculture. A review of the literature suggest that as in most southeast Asian countries, the domestic fish marketing channels in Bangladesh are characterised by long chains and complexity (Chauhan, 1995; Hussain, 1995; Karundeng and Sudari, 1995; Young, 1994). Usually fish from freshwater open capture fisheries passes 4-8 levels before it reaches to final consumer from the farm gate, tending to raise the marketing margins (Barker, 1989). Marketing intermediaries undertake a range of important functions and play a significant role in the marketing and distribution of fish throughout the country. Overlooking the

positive role of intermediaries in providing marketing services particularly to small farmers, agricultural policymakers in many developing countries have had a tendency to perceive them as parasites who take away a large share of the benefit accrued from the sale of products by taking advantage of small farmers' limited awareness of market prices (Ellis, 1996). Such a perception is also clearly reflected in policy papers and development reports (Mohtar, 1997; Lee, 1997; Gunawan, 1997; Khushk, 2001).

While government policy and service regarding the marketing system has a direct influence on the price of products (Hotta, 1995; Zellera et al. 1998), there is no fixed pricing policy in the fish marketing in Bangladesh. Demand and supply, subject to the influencing variables including species, size and quality determine fish prices. Seasonality is expected to be of particular importance in the trading of aquatic products in Bangladesh, where seasonal rainfall patterns greatly affect availability of wild fish in the market and demand for culture, food and seed fish. In this context, improving access to market information may be a key mechanism for ensuring poor people can retain or increase their role and benefits in marketing fish, a highly perishable product. Quality of market information and its dissemination could be crucial for price determination (Young, 1994). Yet, an improved understanding of the channels of marketing information and market feedback into production decisions should allow us to better understand the consequences of marketing aquatic products on creating and developing human and social assets within the system (DFID, 2005).

In contrast, the role of marketing, channel intermediaries and their benefits through involvement in servicing aquaculture have frequently been ignored, possibly because they are inherently more complex, less tangible and data records are commonly poor or non-existent. However, the few studies attempted in the recent past were focused mainly on the trading system (marketing systems, identifying formal channels, marketing margins etc.) rather than producers, traders and consumers (Sarker, 1999). In view to support policy development current study will identify marketing

mechanisms and linkages of fish marketing, role of channel intermediaries and their share of benefits.

Sustainable livelihoods approach provides a locus for development interventions through various 'entry points' by which poor and vulnerable groups can be identified, means of development can be found and processes can be identified to improve livelihoods. The livelihood framework also allows analysing of how the assets, activities and access of poor people has been changed through the growth of aquaculture (Pullin, 2001).

Finally the adoption and intensification of aquaculture, with the growth of domestic and global markets of high value farmed aquatic products, including farm and non-farm employment are prompting priority need for reviewing impacts on rural livelihoods. An improved understanding of the trend of adoption of aquaculture, particularly small-scale aquaculture, and marketing of the products should inform and assist policy development in Bangladesh and allow more meaningful and efficient targeting of poorer people. Therefore, the research aims to analyse the broader impact of aquaculture production and marketing on rural livelihood, particularly the poorer section of society and will test the assumption that aquaculture is benefiting poor stakeholders through out the value chain by testing the broader hypotheses below;

1.3 Broader research hypothesis

Aquaculture production and marketing have significant impacts on enhancing rural livelihoods in Bangladesh

Working hypotheses

The broader hypothesis will be tested through testing the working hypotheses below:

- 1.3.1.1 Promotion of aquaculture production enhanced rural livelihoods of Bangladesh including poor people.
- 1.3.1.2 Aquaculture production has enhanced women's productive role and benefits.
- 1.3.1.3 Marketing of aquaculture products in Bangladesh is becoming diverse and enhancing aquaculture production and rural livelihoods.

CHAPTER 2 Methods and processes

This chapter describes the broader research process followed to explore the impacts of aquaculture production and marketing on rural livelihoods for testing the working hypotheses stated in section 1.4.1 in Chapter 1. The process includes development of a conceptual framework, design of a research framework, identification of strategies, methods and tools for different stages of the research. However, sample size and number of participants in different activities have been presented in individual chapters (Chapter 3, 4 and 5).

2.1 Conceptual framework

The aim of the research was to explore the impact of the production and marketing of different aquaculture products in wider rural communities. The research was “people centred” which spotlighted more on “livelihoods” of people employed in aquaculture production management than the technology or yield of products at production level. The people servicing with marketing were the more focused than demand and supply of products. The research used the “sustainable rural livelihoods” concept for understanding the wider livelihood context and the “livelihoods framework” to analyze the impact of aquaculture on household and rural livelihoods in order to achieve the aim of the research. A brief overview explaining the livelihood concept and livelihoods framework has been outlined as background in Chapter 1. Although research on livelihoods using the “sustainable livelihoods concept” broadly looks at almost any aspect of the way people go about gaining a living, the research was more focused on “aquaculture production as a livelihood option” and “market and marketing as mediating institution. Livelihoods were considered at a macro level whilst livelihood outcomes” of stakeholders at micro level were a focus. As such the

study attempted to narrow down to livelihood assets, processes, strategies and finally outcomes in the livelihood framework.

Several approaches have been used for understanding to conduct a marketing situations. However, “commodity sub-sector approaches” is one the most commonly used approach (Abdula, 2005). The sub-sector analysis is gaining attention in institutional analysis, including marketing. So, the final conceptual framework for the study was developed combining “the sub-sector” concept within the “livelihoods framework” and covered the shaded cells shown Figure 2.1.

Livelihood frame work	Sub-sectors and sub-sector participants								
	Aquaculture production			Domestic fish marketing			Export marketing		
	Farmer	Women	Labourer /fisher	Retailer	Auctioneer	Support Service people	Depot owners	Support Service people	Processor and Exporter
Livelihood assets									
Vulnerability context									
Policies Institution and processes									
Livelihood strategies									
Livelihood outcomes									

Figure 2.1: Conceptual framework of the research
 (Source: Adopted from Keith and Oudwater 2003)

The livelihood framework incorporates a broad context and relationships inherent in rural livelihoods. It therefore, highlights the importance of a qualitative component to livelihood analysis. Many impact assessments use quantitative information and make an attempt to show how certain inputs lead to certain development outputs through large-scale statistical analysis. The other assessments depend on qualitative data where the causal chain is seen as more important rather than statistical correlations

(Stirrat, 2003). But a combination of both qualitative and quantitative techniques is probably the most popular for understanding livelihoods (Chambers, 2001b).

Qualitative and quantitative methods are increasingly considered as complementary to one another in livelihood analysis. In such a combination, qualitative methods allow the assessor to identify a wider view of different issues and outcomes, which can then be used to frame more narrowly focused quantitative research. Howe and McKay (2005) noted that although quantitative methods have been very informative, they also suffer from limitations with regard to understanding factors and processes underlying poverty. As it is difficult to explore impacts using only large-scale quantitative analysis (Stirrat, 2003; Howe and McKay, 2005), therefore the current research combined ‘qualitative’ and ‘quantitative’ data collection methods.

2.2 Overview of the approach, methods and tools used

2.2.1 Research approach

The sustainable rural livelihoods concept and framework places great importance on “participation” of stakeholders for both research and development. Ensuring complete participation of stakeholders at all stages of the research was the main principle of selecting data collection tools and methods and during data collection. Therefore, a suite of tools or methods were used for the current research, which are collectively known as Participatory Rural Appraisal (PRA).

Participatory Rural Appraisal (PRA) approach and methods are being increasingly used in research and development process, particularly in developing countries. Participatory Rural Appraisal originated 1980s sharing some of the principles of Rapid Rural Appraisal (RRA). Chambers (1994) noted that the term is being used to describe a growing family of methods to enable local people to share experience to plan and act. Participatory Rural Appraisal is called "an approach and methods for learning about rural life and conditions from, with and by rural people" (WCED,

1987). Participatory Rural Appraisal developed from approaches, traditions and methods of participatory research, applied anthropology, and field research on farming systems (Gilbert et al. 1980; Shaner et al. 1982) and has mostly from a synthesis of agro-ecosystem analysis (Gypmantasiri and Conway, 1980; Conway, 1986). Bene (2003) and (Conway, 1987) described PRA as a starting point for understanding local situations in a broader context.

Participatory Rural Appraisal results have been compared with more formal farm and household surveys used on conventional quantitative social research methods, but no significant differences have been observed between the two approaches (Franzel and Crawford, 1987; Rocheleau et al. 1989; Kothari, 2001).

Participatory Rural Appraisal, however, is not without its critics. Gladwin et al. (2002) pointed to much reliance on untested ethnographic observations that are made over brief periods of time. They claimed that the conclusions reached using participatory methods frequently ignore individual variation in participant behaviours in order to focus on the similarities among them. While Kapoor (2002) argued that the role of PRA facilitators, the personal behaviour of elites and the questions of legitimacy, justice, power and the politics of gender and difference are sometimes ignored.

2.2.2 Well-being ranking

Stratification of households according to levels of well-being is a widely used tool in research and development. The traditional approach to the measurement of household wealth ranking through standardised household interview surveys have been replaced by many poverty alleviation research and development programme (Scoones, 1988). Well-being ranking is effective in targeting a specific group, particularly the poor who are often ignored during planning and development, and in focusing research through understanding specific constraints of different groups (Hediger, 2000).

The current study used “well-being” rather than “wealth” in a ranking process for stratifying the households. Wealth is defined in terms of access to or control over important economic resources (Goulet, 1994), but well-being is a broader term that can encompass social status, positive attitude etc. In well-being ranking, participants are asked to identify their own perception of their status in a certain livelihood context. Therefore, this can include social, education, health, culture etc. along with wealth (asset holdings) (Stirrat, 2003). Well-being stratification of rural households in Bangladesh is important to understand the nature and extent of vulnerability. In a recent aquaculture impact study Karim (2006) used well-being ranking to stratify households into better-off and worse-off before understanding socially aggregated focus group activities. While in another impact assessment study, Islam (2007) grouped rural households into three as better-off, medium and worse-off. Haque (2007) also classified rural households into richer, medium and poorer categories to identify impacts of rice-fish farming on rural livelihoods and the adoption process of the technology.

2.2.3 Focus group discussion (FGD)

Focus group discussion is one of the most widely used participatory methods in both PRA and PRA (Guijt, 1992a). Focus group discussions can be used to enable different categories of people, particularly disadvantaged groups to identify their priorities and interests. Differentiating by group, interest and gender can be crucial in terms of identifying priorities. Evidence shows that the contrasts can be sharp (Swift and Umar, 1991). Focus group discussion is used effectively in marketing and policy research (Loader and Amartya, 1999). While assessing the implications of implementing Hazard Analysis Critical Control Point (HACCP) regulation in shrimp industry Khatun (2004) used FGDs with various levels of people in the industry, including marketing intermediaries. Ahmed (2001) conducted several FGD with different level of stakeholders in prawn farming, such as farmers, women, fishers etc. to identify socio-economic impact and constrain of prawn farming in Bangladesh.

Focus group discussions can also generate quantitative data along with qualitative information. Shelly (2005) used FGD for stratifying households in participatory monitoring and evaluation, while in Vietnam it was used in participatory poverty assessment by (Shah et al. 1991).

2.2.4 Participatory Mapping

Participatory mapping is one of the most popular PRA tools used in a variety of ways and purposes in research and development. In many cases gathering of information starts with mapping, as it gives a broader view of society and systems (Shahvali and Zarafshani, 2002). But most importantly participants enjoy mapping and thus good rapport is built between participants and researchers/professionals, which later provides them with greater access to in-depth information.

Mapping flows of products can be an effective tool for identifying marketing chains, markets and networks, which can be then used to capture other required information through group discussions (Kleith et al. 2003). Barman et al. (2002) used mobility mapping to identify the social impacts of small-scale aquaculture. Human mobility mapping of farmers was also found to be used in aquaculture technology dissemination and adoption in the north-west Bangladesh (Islam, 2002).

2.2.5 Observation

Observation as a research method involves 'systematically observing objects, events, processes, relationships or people and recording these observations' (PAPSL, 1997). Bowling (1997) also added that systematic observation is a classic method of enquiry in natural science (people's experimentation, knowledge and values). Advantages of the use of direct observation as a research method has been emphasized by many researchers particularly for case studies (Atkinson and Delamont, 1985; Robson, 1993). Moreover, Simpson and Tuson (1995) noted that there is almost no research strategy to which data collection by observation cannot contribute. Observations in

this study were used mainly to collect information of marketing activities, particularly during product processing and handling. Kleith et al. (2003) suggested that in fish marketing research direct observation of operations and facilities helps to improve understanding and to cross-check the data already obtained. Islam et al. (2004b) studied auction markets and activities in Dhaka through observation.

2.2.6 Case studies

The case study has been widely used as a research method in a variety of disciplines, including natural sciences. A case study is a context or situation commonly studied as a single unit and has clear boundaries. It may be an investigation of an organisation, an event, a process or a programme (Merriam, 1988; Bassey, 1999). Anderson (1998) noted that 'case studies are a holistic research method that uses multiple sources of evidence to analyse or evaluate a specific phenomenon or instance'. He further elaborated that 'case studies are a useful way to systematically look at a specific case, collect data, analyse and interpret findings within their context and report results'. Bassey (1999) in his critical review on case study suggested that the case study can lead to an understanding of the complexity of a particular context. Case studies have been used in the current research to explore the in-depth impact of aquaculture and marketing on stakeholders' livelihoods.

2.2.7 Questionnaire survey

Surveys based on structured questionnaires are an orthodox, but useful tool for data collection in social research (Bassey, 1999; Cohen et al. 2002). Although large scale questionnaire surveys are sometimes criticised for their high costs, errors and other defects (Bleek, 1987; Inglis, 1991; Inglis, 1992; Gill, 1993) for one-off investigations or for longitudinal studies, they remain one of the most widespread and sustainable methods of rural research (Guijt, 1992a). Ellis (1998) and DFID (2000) suggested that using questionnaire surveys can provide reliable data on livelihoods strategies and

outcomes. Data gathered by questionnaire provide an opportunity to compare across cases and across wealth groups on the basis of wealth categories (Islam, 2002).

2.3 Research processes: Strategy, methods and tools used

2.3.1 Research strategy

Three main strategies were considered for study site, entry point and data collection for the research.

Study site: The research site selection strategy was developed combining two aspects; “production technology” and “marketing features (types)”. The following three major aquaculture technologies were taken for study and site selection;

Farming prawns in *gher* systems.

Conventional fish farming in ponds.

Integrated fish farming with rice.

An overview of the above three technologies has been outlined in Chapter 1. On the other hand, marketing of aquaculture products in Bangladesh can be characterised into three following three types;

Export marketing (products from aquaculture exported)

Nationwide fish marketing: fish exported to other region in the country and big cities.

- Localized marketing: Local fish is marketed and consumed within the area.

A brief of the above three types of aquaculture marketing has also been outlined in Chapter 1.

Combining the above marketing types and production technologies the following three principal strategies were developed to take the research process forward;

- i) The research would cover an area where farmers produce prawn in *gher* systems and the major proportion of products were channelled through for export.
- ii) The research would cover another area where aquaculture, including small-scale farms, had become more intensified and diversified and the products channelled to big cities and other areas where there was gap between fish demand and local supply.
- iii) The third and final coverage was an area where integrated rice-fish farming had become established by small-scale farmers. The fish cultured were channelled to local markets for consumption.

Entry point: The second strategy was to process the research (as an entry point) through collaborating organization/institutions, which had backgrounds of working with target aquaculture technologies of the research in each site. Therefore, the research identified three collaborators according to the strategies.

Starting point: The data collection process was started among producers and followed product flows/channels through intermediaries to consumers.

A flowchart of four major phases of the research is outlined in Figure 2.2.

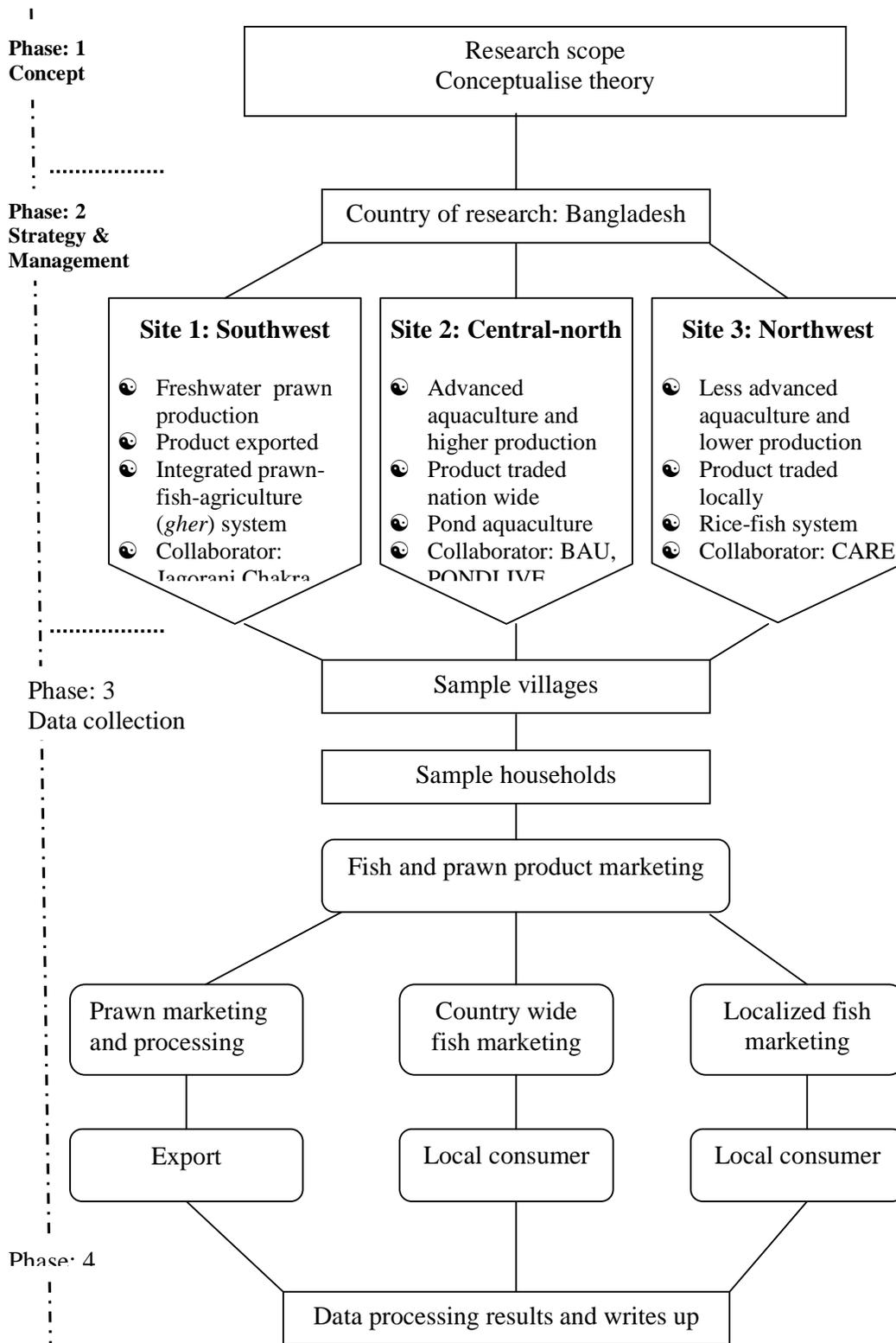


Figure 2.2: Flowchart of research process

2.3.1.1 Study sites

According to the above mentioned site selection strategy, following three districts from three regions in Bangladesh were selected for the study.

Jessore district: For studying prawn production and export marketing.

Mymensingh district: For studying intensified aquaculture production and marketing

Dinajpur district: For rice-fish production and fish marketing.

The locations of the study sites are shown in Bangladesh map (shaded) in Figure 2.3.



Figure 2.3: Map of Bangladesh showing study sites

A brief of the selected district and justification is given below;

2.3.1.2 Jessore district

Jessore district is situated in the south-west region of Bangladesh which has a border with the coastal districts of Khulna and Shatkhira. The district consists of 8 Thanas (administrative area under district) and other major statistics is presented in Table 2.1.

Table 2.1: Major statistics of the study districts

	Districts		
	Jessore	Mymensingh	Dinajpur
Total area (km)	2578	4363	3438
No. of thanas	8	12	13
No. of villages	1434	2712	2149
No. of households	521360	965140	57160
Population	246980	4460120	2640940
Male-female ratio	1 : 0.93	1 : 0.95	1 : 0.95

(Source: Bangladesh Bureau Statistics 2004)

Rice and vegetables are the main agricultural crops of the district. Jessore is famously known as being very rich in freshwater resources of *baors* (ox-bow lakes) and *beels* (natural depressions). As such, fisheries play an important role in rural livelihoods, for both income and consumption. Export oriented freshwater prawn farming in *ghers* has been introduced and expanded rapidly and organically. Farmers adapted the technology in the low lying areas of Jessore during the 1990s. Prawn farming was first started mainly in the coastal areas (Bagherhat, Khulna, Shatkhira districts), from where it spread to Jessore. Most studies on prawn and shrimp farming in *gher* were based in coastal areas and have identified significant positive impacts on livelihoods, but social and environmental negative consequences were also documented.

2.3.1.3 Mymensingh district

Mymensingh district is situated in the north-central region of Bangladesh having a border with six other districts (Figure 2.3) around it. The major statistics of the district are presented in Table 2.1.

Cereal crops and vegetables are the main agricultural products of the district (Karim 2006). Beside agriculture, aquaculture has increasingly gained a greater role in the rural economy. Conventional pond fish farming is known as more developed with improved techniques in this district, than in many other districts. Institutions (educational, research and development projects) and road communications with the capital city probably have influenced aquaculture development (Karim 2006). In many villages, small-scale farms are being operated with a commercial attitude (ADB, 2005; Bouis, 2000) with improved management. In this context, the current study selected Mymensingh district to investigate the impact of intensification of aquaculture and marketing of products on rural livelihoods.

2.3.1.4 Dinajpur district

This district is situated in the north-west region of Bangladesh having a border with five other districts (Figure 2.3). The northwest part of Bangladesh is the driest part of the country and is characterised by sandy loam soils with poor water retention capacity. The major statistics are presented in Table 2.1.

Dinajpur district is an important rice growing area of the country and famous for the fine rice variety '*kataribhog*', as well as vegetables (CARE, 2001). Aquaculture, though very important, has been less developed in this area compared to other parts of the country. As a result fish produced in the district does not meet the demand. As the district is dominant for growing rice, integrating aquaculture with rice cultivation has great potential (Barman and Little, 2006; Haque, 2007). Realising the potential of rice-fish in this district DoF, CARE Bangladesh and other NGOs had been working to

develop and extend the technology over the last 12 years. Therefore, integrated rice-fish farming has gradually expanded and become established among many farming households. Dinajpur was therefore selected for the study district for rice-fish integrated system and marketing of aquaculture products.

2.3.2 Research collaborators

According to the strategy of identifying entry points, the research had identified three collaborators that had a background of working with farmers in the target aquaculture systems in the selected regions. Secondary data was collected regarding the status of aquaculture technologies from these collaborators and later villages were sampled from those villages regions. The research collaborators provided important support in initial setting up of the study, which included secondary data of target technologies and practices, took part in the village selection process, initial rapport building with local people from sample villages and households and the sharing of ideas at different stages of the research.

A brief overview of the three research collaborators is outlined below;

2.3.2.1 Jagorani Chakra (JC) in Jessore district

Jagorani Chakra was identified as a potential collaborator in Jessore district for studying freshwater prawn production and the marketing aspect. A formal verbal contract was made between JC and University of Stirling for the study collaboration.

Jagorani Chakra is one of the largest local NGOs in Jessore. They have a wide range of programmes and activities included both technical support and microcredit for *gher* farmers. The Jagorani Chakra agricultural programme includes supporting *gher* farmers with micro-credit and technical aspects. It has been working with prawn farmers since 1998 in Monirampur and Keshobpur thanas is considered most suitable for *gher* farming in Jessore district. At the time the study was initiated, JC was

working with 1036 *gher* farmers in 30 villages in those the two thanas. These villages were referred as to JC “contact villages” and the farmers involved with the JC program were as JC “contact farmers” in the thesis. Accordingly, study villages in Jessore district were sampled from JC contact villages.

2.3.2.2 POND LIVE Project, Bangladesh Agricultural University in Mymensingh district

The POND LIVE Project was a multi lateral research project among five countries funded by the European Commission. The project covered pond dike systems in Bangladesh, Thailand and Vietnam. One of the three general objectives of the project was to analyse the impact of pond aquaculture on the livelihoods of Asian farming households; and to understand the role of aquaculture ponds in nutrient cycling on farms. It was believed that improved nutrient management has a useful role to play in increasing efficiency and total farm productivity, which benefiting livelihoods. The project worked in six villages in Mymensingh district during 2001-2005. The current study villages in Mymensingh were sampled in collaboration with POND LIVE Project from these six villages. An oral agreement processed the collaboration.

2.3.2.3 GO-INTERFISH Project, CARE Bangladesh in Dinajpur district

Greater Opportunities for Integrated Rice-Fish (GO-INTERFISH) Project of CARE Bangladesh worked in nine districts of northwest Bangladesh including Dinajpur district during 1999 – 2005. The goal of the project was to enhance the livelihoods of poor people in its command area through adoption of improved agricultural practices. GO-INTERFISH targeted a total of 400,000 small and marginal farming households owning less than 0.6 ha of land (CARE, 2001).

GO-INTERFISH worked with farmers by establishing farmer field schools (FFS) in collaboration with local NGOs in order to improve land resource use through diversifying farming systems, which included integration of fish within rice

cultivation (commonly termed as “rice-fish farming”), integrated pest management (IPM) and use of ricefield dikes for vegetable cultivation. The project supported each FFS for 18 months after which support was withdrawn or phased-out’ villages. The current study villages in Dinajpur district were sampled in collaboration with GO-INTERFISH project from such the phase-out villages in Dinajpur district where rice-fish was been sustained without project support. A written collaborative agreement was made prior to the study inception.

2.3.3 Process of sampling study villages and farming households

The sample villages were ‘purposively’ selected from collaborator’s ‘contact’ villages. Surveys were conducted with key informants (KI) aiming to develop overall understanding and dynamics of villages, and to identify the most suitable villages for achieving the aim of the study. Union Council Members, school teachers and NGO staff, who had a good knowledge of most of the households in the community and were willing to co-operate were selected as KI at different levels of the study. The following three aspects were considered as the village selection criteria according to the interest of research. Therefore, the survey focused on gathering information on those aspects;

i) Occupational status: Overall occupational status of households was considered as first criteria for selecting study villages. Data was collected on the occupation (in %) for each village as a whole to ensure that the selected villages had a higher proportion of households involved as producers and/or employee in the targeted aquaculture farming systems.

ii) Economic status: Overall economic status of was considered as the second criterion for selecting study villages. Data was collected on the overall comparative economic status of villages (% of worse-off, medium and better-off households). Villages with a higher proportion of worse-off households were selected.

iii) Farmers' marketing practices: Farmers marketing practice (where and how they sell their fish) was the third and final criterion for selecting villages. Therefore, data was collected through the survey on farmer's marketing practice in order to capture the dynamics of product marketing and that the villages sampled included most criteria of marketing features. Finally, the study sample villages were sampled randomly from those meeting the three above criteria.

2.3.3.1 Process of sampling villages

The village selection process was carried out separately for each selected district using the above three criteria. The process was completed in sequence, following 4 steps; i) list of collaborator's contact villages were prepared, ii) the listed villages were sorted by occupational criterion (first) using a certain cut off point (% of household involved in targeted aquaculture system) considering the result of the above mentioned survey. The cut off point was different for the three sites and are discussed in the respective chapters (Chapter 3-5), iii) the villages passed through the first sorting were further sorted by economic status (second criterion) using certain cut off point (% of worse-off households), iv) villages passed through the second selection were divided into two groups considering the marketing practice of farmers in each site. The dividing criteria was different for three sites and discussed in respective chapters and v) finally two villages were randomly sampled from each of two above groups totalling four villages for each district. This number (4) of sampled selected villages for each district for the study was planned according to the resources and time allocated for the research. One of the two selected villages from each group had been selected totalling two villages for each district for studying marketing of aquaculture products.

Household selection

Sample households were selected for each village separately using the same procedure for all villages. To ensure participation of worse-off households, all

households in each village were firstly divided into two categories a) households involved in target aquaculture farming as producer (referred as “farmers” or “farming households”) and b) households not involved in target aquaculture as producers (referred as “non-farmers” or “non-farming households” in the thesis). Then farming households were divided into two categories c) worse-off households and d) better-off households through ‘well-being ranking’. Thus all households of a village were divided into four categories.

Detailed procedure of sapling study households

Household list

A complete list of all household heads was developed through a key informant (KI) from each village with the assistance of the research collaborators support staff. Then the household list was checked by a small group of villagers to ensure that all households were included. The name of all household heads was written individually on small cards and a serial number was given on the card for each household for identification. Then cards (households) were divided into two groups as aquaculture “farming households” and “non-farming households” by a KI and small group of people and were written accordingly on the back of each card. Then the cards were used for well-being ranking to identify worse and better-off households

Well-being ranking

The study planned to carry out well-being ranking with identified key informant (KI) but in real practice there was always a few people gathered to form a small group of 4-5 people that undertook the ranking process with the KI. Shelly (2005) used focus group for wealth-ranking in a aquaculture study in Vietnam. Well-being was conducted following the steps below;

i) Sitting at a suitable place the group involved was briefed about the purpose of well-being activity and about the cards those holdings names of all household heads in the village. Then cards were distributed to them to see and to get them involved in the activity. The cards were then taken back and bundled again. From the bundle two cards were taken and then names of the household on the cards were read out to the group and the group was asked, “ who is living more comfortably between them?”. KI in discussion with the group came up with one card (household name) and then he was asked to place the card on floor keeping the more comfortably living households to the left. A third card was then given to KI to read out the name on card and was asked where the card should be placed comparing first two cards (households) regarding “living more comfortably”. After discussion with the group, if the KI found that the third card (household) was similar to one of first two cards then he placed the card on top of one of the two cards, if not then a third pile was created. The processes repeated in same way and it took about 5-6 cards for the group to understand fully what was required. At this stage the process was stopped for a while and the group was asked about the criteria they were using to determine the cards (households) as living comfortably. Then the criteria pointed out by the group were noted. Usually the criteria and their importance varied little among villages (Stirrat, 2003).

ii) After discussing and fixing the criteria, the well-being ranking process resumed. At that stage the bundle of cards was give to KI to continue the process and the research staff member observed the process and noted important points from their discussion. The process was continued until all the cards were dealt.

iii) The number of piles was kept within 4-6. If the process resulted in more than 6 piles, then they were asked to review the pile containing the least number of cards and distribute those to neighbouring piles. That process was continued until the number of piles were reduced to six. On the other hand, if the process resulted in less than four piles, then they were asked to review the biggest pile and to create new a pile from the biggest pile to make it into at least four piles.

iv) Once the all cards were assigned to 4-6 piles, each pile was read back to the KI and group and minor changed after discussion and was reviewed

v) Then each pile was turned over and scored on the back of the cards individually. If there was five piles of cards, then each card of the extreme left was numbered 1/5, cards in the second left pile was scored 2/5 and so on to cards in the fifth (extreme right) was numbered 5/5.

vi) The cards were shuffled and the whole process (number i. to v.) was repeated twice with fresh KI plus small groups at two different locations in the villages.

vii) Thus each card (household) got three marks at the back and the marks were then converted to scores and the average score was written on the card (front side). Thus, all the cards got a score ranged from 0.02 to 1.0, where 1.0 was the worst-off and 0.06 was the best-off households in that village. Finally households (cards) were divided into two categories a) “worse-off”; whose score was >0.5 and b) “better-off”; whose score was ≤ 0.5 .

Finally six households from worse-off and better-off farming households were sampled randomly by lottery totalling 12 households for each village. Thus 48 households were selected for each district totalling 144 for the study.

2.3.4 Questionnaire survey to establish household profile and impact of aquaculture on livelihoods

The main data collection activities were started with a survey of all sample farming households from the three study sites (districts) using structured questionnaire during September-October 2003 (Appendix 1). The purpose of the survey was to generate individual household level information and to improve understanding on the impact of aquaculture production on household livelihoods. Therefore, the questionnaire was designed to collect required basic information (household member, age, sex, education and assets), livelihood trends, and impacts of aquaculture on livelihoods. To

capture dimensions of impacts on household livelihoods, both closed and open ended questions were combined in the questionnaire to collect both qualitative and quantitative data. The questionnaire was validated before data collection through the process described later in 2.3.15. The survey was followed by monitoring the sample households.

2.3.5 Monitoring households

In addition to above one off data collection with questionnaire, sample farmers were monitored monthly for 12 months from October 2003 to September 2004 (Appendix 2). The purpose of monthly monitoring was to collect longitudinal data for households on income and expenditure and consumption.

2.3.6 Focus group discussion with farmers

There were two main purposes of the focus group discussion (FGD) with farmers. Firstly, to develop understanding on farming system dynamics and trends, and impacts of aquaculture at village livelihoods. Secondly to identify other stakeholders of aquaculture production and interactions and contacts among them. In this event, all sample and non-sample farmers (farmers those who were not selected as sample farmer) participated in the FGDs in order to get a broader view of aquaculture impacts. To ensure that the non-sample farmers were selected from different parts of the village, a list of household heads was used for selecting non-sample farmers. The number of participating individuals in each FGDs ranged between 18 and 22. The number participants were high because of participation of both sample and non-sample farmers. Farmers' participation was ensured through rapport building, motivation, directly asking for opinion or experience.

2.3.7 Mapping markets used by farmers

Focus group discussion was followed by the farmers drawing a map indicating the markets they sold their products and roads to markets. The purpose of participatory market mapping was to identify the markets used by the farmers and to use the map to facilitate the discussion on farmer's marketing practice and other relevant issues in details. Though mapping, particularly social mapping exercises encourages using local material as much as possible, the current study used big white paper sheets for drawing the position of markets and roads due to mainly time limit and to ensure same level of compatibility (mapping was followed by FGD). The map and other relevant information were also used later in the study for explaining marketing aspects.

2.3.8 FGD with aquaculture labourers

Fish and prawn farm wage labourers were identified as one of the main groups of stakeholders at the production level in the research villages. Traditionally individual agricultural wage labourer works for different agricultural activities in different days depending upon opportunities. The wage labourers who were involved in aquaculture were referred as "aquaculture labourers". Focus group discussions were organised for aquaculture labourers separately for each village (Appendix 6). The purpose of the FGDs was to gather information and improve understanding of their roles in aquaculture impacts on their employment and trends in overall livelihoods. The number of labourers participating in each FGD was around 20. A list of aquaculture labourers was prepared and 10-15 labourers were sampled randomly and invited to the FGD. Basically, labourers often attended with uninvited friends.

2.3.9 FGD with fish and prawn harvesting team

Fish and prawn harvesting teams, typically of the low caste Hindu (Barman cast) and considered professional fishers were another group of people employed in aquaculture

production. Members of harvesting teams involved in fish and prawn harvest in sample villages are referred as “fishers” in this thesis. Focus group discussions with fishers were organised separately for each village. The purpose of the activity was to gather information and improve understanding on their roles in aquaculture and trends, and impact on their employment and overall livelihoods in relation to their inherent fishing profession in open waters. The number of fishers participating in the FGDs was around 20, sampled in the same way as the aquaculture labourers.

2.3.10 Tracking farmed fish and freshwater prawn chain

The study tracked same batch of fish from the point of harvest at the farm site to the final consumer and prawns were tracked from farm gate to processing plants. The purpose of tracking the same batch of fish and prawns was to identify the marketing chain of products, the level of intermediaries involved, the specific activities carried out and the people involved along with other relevant aspects. Fish were tracked to consumers at two different retail markets, while prawns were tracked to the gate of processing factories. A checklist with broader headings was used for data and information recording, rather than any structured questionnaire to capture the wider picture of marketing activities and roles of different people.

2.3.11 Observation of marketing activities

Detailed information of marketing activities was collected through observation of markets through a complete working cycle i.e. opening to closing. Observation on mechanisms and dynamics of fish marketing as well as collecting of information on a whole range of operational activities and people responsible for those activities and their interactions was made. A checklist with broader headings was used for data and information recording, rather than any structured questionnaire.

2.3.12 FGD with marketing intermediaries

Following observation, FGDs were organized with the intermediaries to complement observations with more emphasis on contracts, payments and trends along with time to discuss and clarify the observations made previously. Focus group discussions with intermediaries were organized only at observed markets as mentioned above. The number of intermediaries for each level (retailers, auctioneers, labours etc.) was collected during FGDs and was used in determining sample size later in the questionnaire survey.

2.3.13 Questionnaire survey of marketing intermediaries

All levels of marketing intermediaries in the market studied were surveyed using a semi-structured questionnaire (Appendix 3). The purpose of the survey was to collect data on general livelihood aspects and the impacts of fish or prawn marketing on employment and livelihood outcomes. To capture dimensions of impacts on household livelihoods, closed and open ended questions were combined in the questionnaire to collect both qualitative and quantitative data. The questionnaire was validated before data collection through the process described in 2.3.15.

2.3.14 Questionnaire survey with women involved in aquaculture

Women involved in aquaculture in the sample villages were surveyed using a semi-structured questionnaire (Appendix 5). The purpose of the survey was to identify the specific roles of women in aquaculture production systems in the study sites and the impacts on household and community livelihoods. Therefore, the questionnaire was designed to collect information on women's involvement in aquaculture, the effect on the household, their benefits and problems. Broader perceptions of women regarding impacts were captured using both closed and open ended questions. The questionnaire was validated before data collection through the process described in 2.3.15. Three female staff, one for each site (employed from one of the sample villages for each

site) carried out the interviews with women individually (no male household member was present at the interviews).

To gain a wider view of impacts on women at community level women were randomly sampled for the survey totalling 34-39 woman per village.

2.3.15 Questionnaire development

All the questionnaires were developed to meet the overall study objectives and to test defined hypotheses and validated through the following the steps.

Draft preparation: Findings and ideas from FGDs, observation, informal discussions were incorporated at this stage for all the questionnaires used in the study. Questionnaires from secondary sources (for similar works) were collected and reviewed and, useful points were considered for designing the questionnaires.

Finalizing questionnaire: Draft questionnaires were presented to research collaborators staff and their comments were considered. Then questionnaires were reviewed by supervisors (academic and local) and their comments were incorporated in to final the draft.

Field testing questionnaire: Draft final questionnaires were field tested with 4-5 people from one village (neighbouring to sample villages) in each of the three study sites. Questionnaires were modified according to field test experiences.

2.3.16 Data processing and analysis

Study data obtained from different methods were initially entered in computer using Microsoft Access. The entry programs for different sets of data were developed by a computer programmers' at WorldFish Center, Bangladesh. The qualitative data were carefully coded and the code numbers were entered. After entering data all necessary tables and queries were created in Access and then exported to SPSS (version 12.1).

Exported data was checked randomly against original completed questionnaires. Errors were detected and corrected satisfactorily for analysis. Then all the analysis was carried out in SPSS (version 12.1).

2.3.17 Quantitative data analysis

Preliminary quantitative data analyses included descriptive statistics such as mean, and standard deviation (SD) and were used to construct tables and graphs presented in results. Normality of quantitative data was checked by histogram normality test and P-P plot. In order to identify the intra and inter group variations, sample means were compared by performing independent T-test, one-way analysis of variance (One-way ANOVA) with post hoc (Tukey) analysis and general linear model (GLM) with post hoc analysis as required. ANOVA is a powerful statistical test where two or more independent estimates of the variance for the dependent variables are compared (Yap, 1999).

2.3.18 Qualitative data analysis

The qualitative data collected in the study were coded before entering to the computer and imported to SPSS for analysis. Preliminary analysis of qualitative data included calculating frequencies, percentages of different variables and cross tables. In most cases the opinions of respondents were grouped in broader categories. Pearson's chi-square test (2X2 cross table) was used to test the significance (differences) for some of the categorical variables where necessary. However, in Pearson's chi-square test, the result (significance) were rejectable, when more than 20% of the cells have expected count less than of 5 and/or minimum expected count is less than one (Field, 2005).

Table 2.2: Research process (methods and tools) against time and purpose

	2003		2004				2005				2006		
Tools/methods	3	4	1	2	3	4	1	2	3	4	1	2	Outcomes
Questionnaire survey	●												Village selection
Well-being ranking	●	●											Household selection
Questionnaire survey (Baseline)	●	●											Livelihood profile of sample households
Farmer monthly monitoring		●	●	●	●								Longitudinal household data on some aspect
FGD and market mapping with farmers			●	●									Aquaculture impact on livelihoods and marketing practice
FGDs with labourers and fishers			●		●	●							Aquaculture impact on employment and livelihoods
Tracking fish and prawn for marketing chain			●			●	●						Identify fish and prawn marketing chain value chain
Observation of marketing			●		●	●							Marketing activities people involved and interactions
FGDs with marketing intermediaries			●		●	●							Marketing trends, contracts and payments
Questionnaire survey with marketing intermediaries						●	●						Impact in livelihoods
Questionnaire survey with women in sample villages							●						Women's role in aquaculture and impact on them
Data processing and analysing								●	●	●	●		Study results

CHAPTER 3 Impacts of *gher* farming in Jessore district

3.1 Introduction

Gher farming, is an indigenous technology developed by farmers in the coastal districts of Bagherhat and Khulna in Bangladesh areas for producing shrimp in semi-saline waters (Mazid, 1994; Aftabuzzaman, 1996) between 1970s and 1980s. But during the 1980s innovative farmers tested the feasibility of the technology in freshwater using the Giant freshwater, prawn (*Macrobrachium rosenbergii*) locally called “*bagda*”. Since 1990, the number of households that adopted *gher* farming in low lying rice fields expanded very rapidly, primarily because the product was exported and offered a high income to farmers compared to other crops (Chapman and Abedin, 2002).

Gher farming began in low lying rice fields around the *beels* (natural depression) in Jessore district in the 1990s (Ahmed, 2001). Some farmers in Jessore learned the technology from their relatives from Bagherhat district and later tried this in their own fields. The results and returns encouraged neighbouring farmers to adopt and thus the practice spread organically (from farmer to farmer) (Chandra, 2003). However, at an earlier stage *gher* farming was adopted by richer farmers with bigger *ghers* in Bagherhat district and then poorer farmers gradually become involved based on smaller holdings (Figure 3.1) (Ahmad, 2001). Adoption appears to have accelerated since 1997 in Jessore district, especially among small-scale farmers with small size *ghers*.

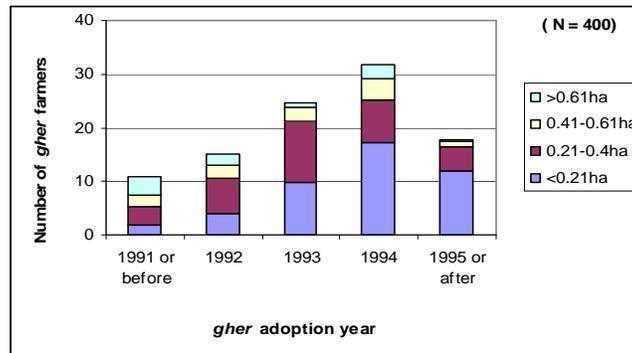


Figure 3.1: Adoption of *gher* farming by *gher* size categories (source Ahmed 2001)

Shrimp and prawn farming had a positive impact on the livelihoods, especially on poorer small-scale farmers as a reliable source of revenue that is often more profitable than other kinds of farming and generated non-farm employments (Chapman, 1997; Fleming, 2004; Khatun, 2004). While Ahmed (2001) reported a significant increase of income from per unit area, Khatun (2004) provided evidence of social problems which included restructuring of land ownership and the poorest farmers being forced to lease out their *gher* to richer neighbour farmers, access to employment in *gher* reduced for local labourers and fighting. Environmental consequences are also well reported (EJF, 2004). As prawn farming has been spreading rapidly beyond the coastal areas, an analysis of the impacts of prawn farming in comparatively recently developed areas would assist policy development.

Markets, marketing and quality aspects of prawn are also important since prawns are exported. As an export product, the post harvest handling and processing of prawn requires a significant labour which created employment. The rapid spread of the technology in Jessore district, also enhanced growth of markets (Chandra, 2003). The above context prompted an evaluation of impacts of prawn production and marketing in Jessore district. The aim of this chapter is to explore the wider impacts of integrated freshwater prawn production in *gher* and marketing rural livelihoods in Jessore district. It analyses the interactions between production and the supply chain, market operations and stakeholders. However, the analysis places most emphasis on on-farm

and non-farm employment throughout the value chain and the impact of employment on rural livelihoods.

3.2 Methodology

This section of the chapter describes the research process (data collection methods and tools) to achieve the objectives of the research (this Chapter). The description included target audience, specific tools used for target audience, sample size.

Data collection at village level on livelihood impacts of prawn production

3.2.1 Selection of sample prawn farming villages

The main concept/strategy of the research process was to start data collection from farming households and progress to assess product flows along the value chain (Chapter 2). Thus prawn farming villages were an entry point for the study as a whole.

According to the study design the study villages were sampled from the contact villages of Jagorani Chakra, the research collaborator in Jessore district and the process was carried out jointly JC. Jagorani Chakra had 30 contract prawn farming villages at the time the study was initiated, of which 19 villages were in Keshobpur Thana and 11 in Monirampur Thana. Jagorani Chakra provided technical support on integrated prawn farming as well as financial support in the form of credit to the *gher* farmers of those villages. The general procedure and the purpose of selecting villages have been described in Chapter 2. However, the specific selection process for Jessore site is outlined below in 3 steps;

Step 1: List of Jagorani Chakra contact prawn farming villages was collected from their office in Jessore.

Step 2: each sample village was surveyed using a short questionnaire to develop an overall understanding of each village with special emphasis on the three village

selection criteria (described details in 2.3.3 in Chapter 2 with purposes). Jagorani Chakra staff working in each contact village was asked to fill in a questionnaire in consultation with a KI (key informant) from each village. The KI was either a union council member or primary school teacher, who had knowledge about the overall socio-economic condition of the villager and prawn farmers.

Step 3: The villages were sorted by occupational and economic status considering the results obtained from the above survey and grouped according to the farmers prawn marketing practice. The summary of the survey results are shown in Table 3.1 and process are described below;

i) Occupational status:

Agriculture and integrated prawn farming were the main two livelihood strategies for most of the resident families in JC contact prawn farming villages in both of the Thanas Table 3.1.

Table 3.1: Overall status of the occupants of JC contact villages in Jessore district

Thana	Livelihood strategies of people of JC contact villages (% average)		Economic status of people of JC contact villages (% average)			Farmers prawn selling practice (% average)		
	Prawn Farming [Range]	Non-Prawn Farming [Range]	Worse-off [Range]	Middle [Range]	Better-off [Range]	Local <i>depo</i>	Commission <i>depo</i>	<i>Foira</i> (middle men)
Keshobpur (n=19)	80.2 (±10.8) [55-90%]	19.8 (±10.8) [10-45%]	33.7 (±9.6) [25-55%]	55 (±13.0) [50-70%]	9.2 (±3.8) [5-0%]	70.5 (±15.9)	23.9 (±15.6)	5.6 (±4.0)
Monirampur (n=11)	83.0 (±9.0) [65-95%]	17.0 (±9.0) [5-35%]	30.0 (±9.3) [15-45%]	58.0 (±5.6) [50-70%]	13.0 (±7.5) [5-25%]	72.7 (±27.3)	24.5 (±23.3)	3.0 (±4.6)

N.B. Local *depo* and commission *depo* is defined below in (iii) Farmers prawn marketing

However, the proportion of people involved in prawn production (prawn producer and non-producers employed in prawn production) varied widely among the villages

within each thana varying between 55% and 95%. Therefore, villages with $\geq 70\%$ people involved in prawn production were prioritised. The criteria ($\geq 70\%$) was fixed to allow more villages with a higher proportion of people involved in prawn production to be included. In Keshobpur Thana out of 19 villages 14 villages were identified where $\geq 70\%$ people were involved in prawn production and in Monirampur 8 villages were identified from 11.

ii) Economic status:

The overall economic status of the resident families in the villagers was considered as the second criterion. From the survey the households in each village were divided proportionately (%) in to three comparative economic classes a) Worse-off (poor living conditions like poor food, clothing, housing b) Middle class (living conditions between worse-off and better-off) and c) Better-off (better living conditions). The result showed that the average proportion of each economic class was similar for two thanas in Table 3.1. However, the worse-off economic class varied from 20% to 55% in Keshobpur Thana and 15%-45% in Monirampur Thana. The study was more interested in worse-off people and so the villages with the greater proportion of worse-off households were prioritised for selection. Villages with $\geq 30\%$ worse-off households were selected for further consideration. In Keshobpur Thana 8 villages out of 14 villages (from first sorting) were identified where $\geq 30\%$ households were worse-off and in Monirampur 6 villages were selected from 8.

iii) Farmers prawn marketing:

Farmers' marketing practices were considered as the third and final criteria for selecting sample villages. Farmers' marketing practices were found to be similar in many aspects between the two thanas. Farmers usually sold their prawn to small buying centres locally known as *depo* (Ahmed 2001) or to *foira* (middlemen, who buy prawn directly from farmers). The *depos* can be divided in to two types: i) Commission *depos*: those *depos* with permission to sell prawn to next intermediary

locally called “commission agent” and ii) local *depos*”: those *depos* had no contract to sell prawn directly to commission agents. Therefore, local *depos* had to sell prawn to commission *depos* after collecting prawn from farmers.

The survey results showed that there was a wide variation among villages regarding farmers selling prawns to the two types of *depos*. In some villages most farmers sell their prawn at local *depos* while in other villages in the same thana more farmers sold to commission *depos*. To capture this variation, villages were divided into two groups as a) villages with $\geq 70\%$ farmers selling to local *depos* and b) villages with $<70\%$ farmers selling to local *depos*. In Keshobpur Thana four villages were identified in group a) and four villages in group b) and finally one village was selected randomly from each group totalling two for the Thana. In Monirampur Thana four villages were found in group a) and two villages in group b) and similarly one village was selected randomly from each group totalling two for the Thana. Thus four sample villages were selected for the study on prawn production and marketing in Jessore named; Pazia and Sharutia in Keshobpur Thana and Anayetpur and Shyamnagar in Monirampur Thana. A flow chart of the whole process is shown in Figure 3.2 and the position of the study villages are shown in the map of Jessore district in Figure 3.3.

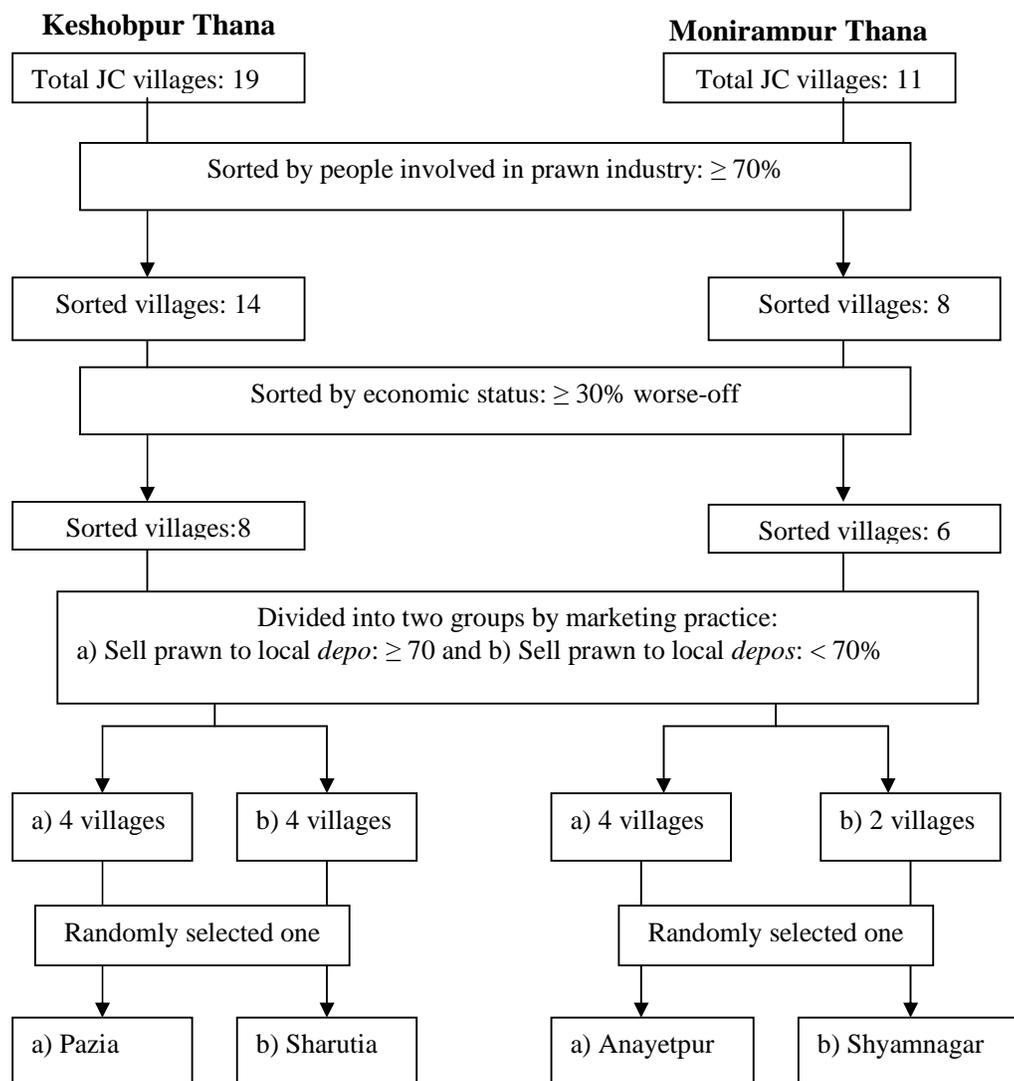


Figure 3.2: Flow chart of village selection in Jessore region

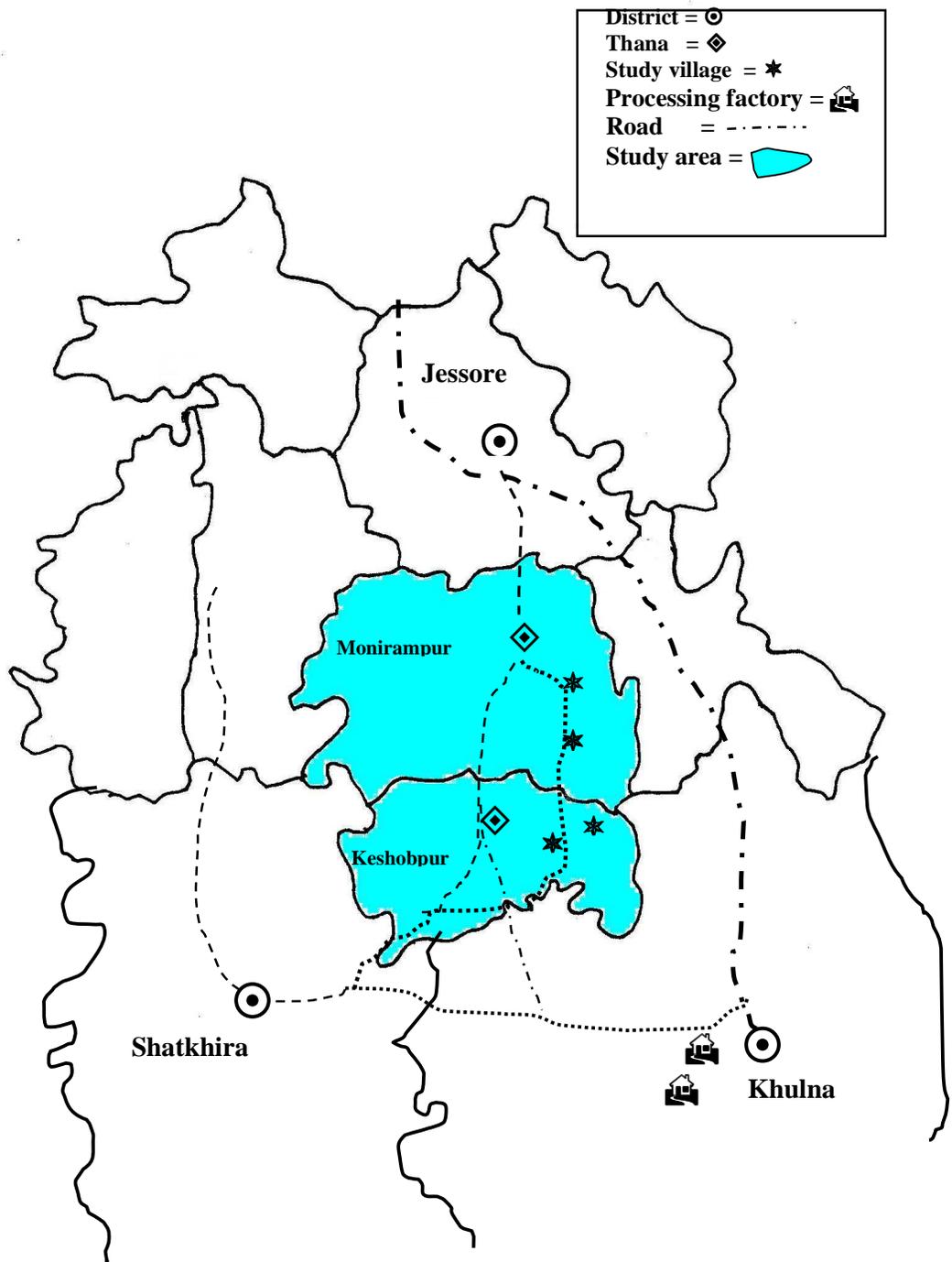


Figure 3.3: Map showing the location of the *gher* farming villages in Jessore assessed in the study and processing factories in Khulna

Selection of sample households:

Ensuring participation of the worse-off prawn farming households in the study was an important consideration of household selection. The process followed a sampling procedure for each sample village. As a first step a list of all households was developed, ii) households were divided into prawn farming and non-prawn farming households, iii) households in the farming category were further divided into worse-off and better-off households using wellbeing ranks and iv) finally 6 households were randomly from each of worse-off and better-off households for each village totalling 12 households per village. The process has been described in detail in Chapter 2.

3.2.2 Sample size for method and tools used

The number of sample for interviews and focus group discussion (FGDs) is outlined below in Table 3.2.

Table 3.2: Number of samples/participants in different data collection tools

Survey tools	Number of samples/participants (total)
Interview of <i>gher</i> farmers (Baseline and monitoring)	48 (worse-off 22 and better-off 26)
FGDs with <i>gher</i> framers	78 (sample and non-sample producers)
FGDs with <i>gher</i> labourers	74
FGDs with fishers (harvesting team)	86
Tracking marketing chain (from farm to consumers)	2 times from 2 villages
Observation of marketing activities	6 local <i>depo</i> , 4 commission <i>depo</i> , 1 commission agent
Individual interview with marketing intermediaries (semi-structure questionnaire)	186
Individual interview with women from fish farming households	139 women from 4 sample villages

3.3 Results

This section of the chapter contains the results obtained through the research process described in previous section (3.2). Results are presented under three sub-sections. Firstly, the livelihood impacts of those involved in production at village level are presented and then the role of women in prawn farming and impacts on them are considered. Finally, prawn marketing systems and the impacts of prawn marketing on farming and broader rural livelihoods presented.

3.3.1 Livelihood impacts of *gher* farming at the village level

3.3.1.1 Livelihood impacts on *gher* farming households

Gher farming in and around the study villages was started during the 1990s. However, it was accelerated since 1996-1997 in the study villages. Initially better-off farmers started farming and then gradually worse-off farmers followed them based on smaller production units. Figure 3.3.1 shows that the *ghers* established earlier to be larger than those established more recently.

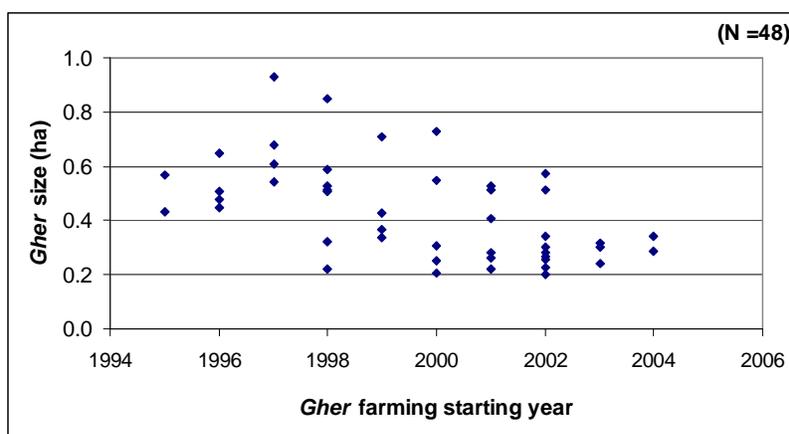


Figure: 3.1.1 Size of the *gher* established in different years

A profile of the livelihood assets of worse-off and better-off *gher* farmers is shown in Table 3.3. The results show that there was a significant difference in size of both *gher*

and agricultural land holding between worse and better-off farmers. But there were no much differences in physical assets between the two categories of households.

Table 3.3: Livelihood assets for *gher* farmers by well-being

Physical assets	Worse-off	Better-off
	Mean \pm Stdev (% farmers)	Mean \pm Stdev. (% farmers)
Family size	5.9 \pm 1.5	6.1 \pm 2.6
Household head age (years)	42.5 \pm 10.6	43.4 \pm 13.1
Household head (5-12 class) %	55%	81%
<i>Gher</i> land (ha)	0.28 \pm 0.10	0.56 \pm 0.14
Arable land (ha)	0.32 \pm 0.12	0.82 \pm 0.43
Homestead land (ha)	0.04 \pm 0.02	0.10 \pm 0.04
Cattle (number)	1.86 \pm 1.62 (71%)	4.68 \pm 2.87 (88%)
Goat (number)	1.74 \pm 1.90 (53%)	2.20 \pm 2.10 (60%)
Poultry (Chicken & duck) number	16.19 \pm 5.40 (100%)	17.10 \pm 5.14 (100%)

***Gher* production system:**

In the *gher* system prawn is grown integrating with other crops; fish, rice, vegetables and fruits in different seasons. Rice is grown in the middle area of *ghers* and vegetables are grown on *gher* dikes.



Figure 3.4: Partial view of a *gher*: showing *gher* components

Prawn and fish production:

A general production calendar (Figure 3.5) and practices found in the study is outlined briefly below.

<i>Gher</i> activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Stocking preparation			■	■								
Prawn stocking					■	■	■					
Prawn harvesting	■									■	■	■
Fish stocking						■	■					
Fish harvesting	■									■	■	■
Rice transplanting	■											
Rice harvesting				■								
Vegetable planting										■	■	
Vegetable harvesting	■	■									■	■

Figure 3.5: A more common main activity calendar for integrated *gher* farming

The new production season starts with *gher* preparation just after *boro* rice (irrigated rice) in March-April. Dikes were repaired as usually they become fragile during rain or flood. Quick lime was applied at about 150-200 kg/ha. Farmers usually stock around 1500-2000 juveniles/ha. However, many farmers kept previous years stocked seed (prawn which were grown big enough to sell) and stock new year seed with previous stock. Multiple stocking was commonly practiced by farmers. June-September was the main growing period for prawn and fish. Farmers often netted the *gher* to check prawn and fish health and growth and harvest marketable size (100-200) prawns (previous year stocked) and fish for home consumption. However, the main harvesting both for prawn and fish was November-January.

Rice cultivation: farmers grew one rice crop annually i.e. *boro* rice (irrigated rice) on the non-excavated part of the *gher* known as '*chatal*' Rice seedlings were transplanted in January and harvested towards the end of April. Farmers usually did not apply any fertilizer to rice because the bottom mud become highly fertile from nutrients applied for prawn and fish.

Vegetable cultivation

Farmers grew a wide range of vegetables of which the most common varieties were sweet gourd, bottle gourd, tomato, egg plant, okra, different beans, cabbage, chilli and turmeric. Along with vegetables, farmers grew fruit mostly banana and papaya. Most of the vegetables were planted in late September or October and harvesting commenced in November and continued to end of February.

Gher outputs and impacts

The main direct impacts of *gher* farming were found in improved household income and consumption. The mean total annual income for households was monitored monthly and the results are shown in Table 3.4. Mean annual income for better-off *gher* farmers for each individual village was significantly higher ($p < 0.05$) than that of worse-off non-prawn households. There were no major difference in mean annual income between the villages.

Table 3.4: Mean annual prawn production and households income

Well-being	Prawn Production		Mean Annual income	
	Household production (Kg)	Yield (Kg/ha)	Taka	UDS
Worse-off	68 (±15.2)	237 (±63.7)	52149 (±11131)	841 (±179)
Better-off	132 (±29.1)	249 (±75.3)	115467 (±34178)	1862 (±551)

The composition of annual household income sources is presented in (Figure 3.6). The average income from prawn was Taka 34817 (±13297) (UDS 562) and constituted 41% of the total annual household income for prawn farmers. Income from prawn was relatively more important among worse-off farmers have (47% of the total household income) than better-off farmers (38% of the total household income). The mean annual income from prawn for both worse-off farmers (Taka 24804) and better-off (Taka 44830) prawn was significantly higher ($p < 0.001$) than other income sources.

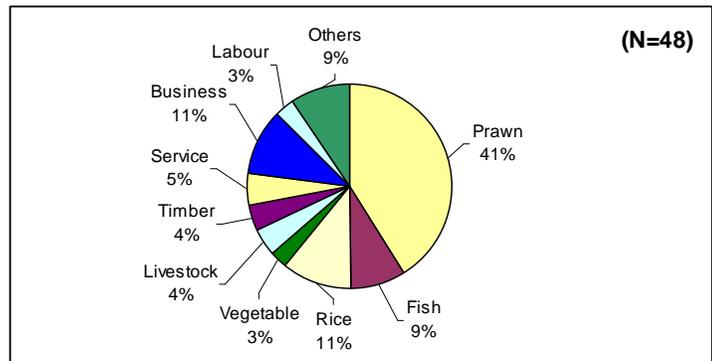


Figure 3.6: Contribution (%) of different income sources to total annual household income for *gher* farmers

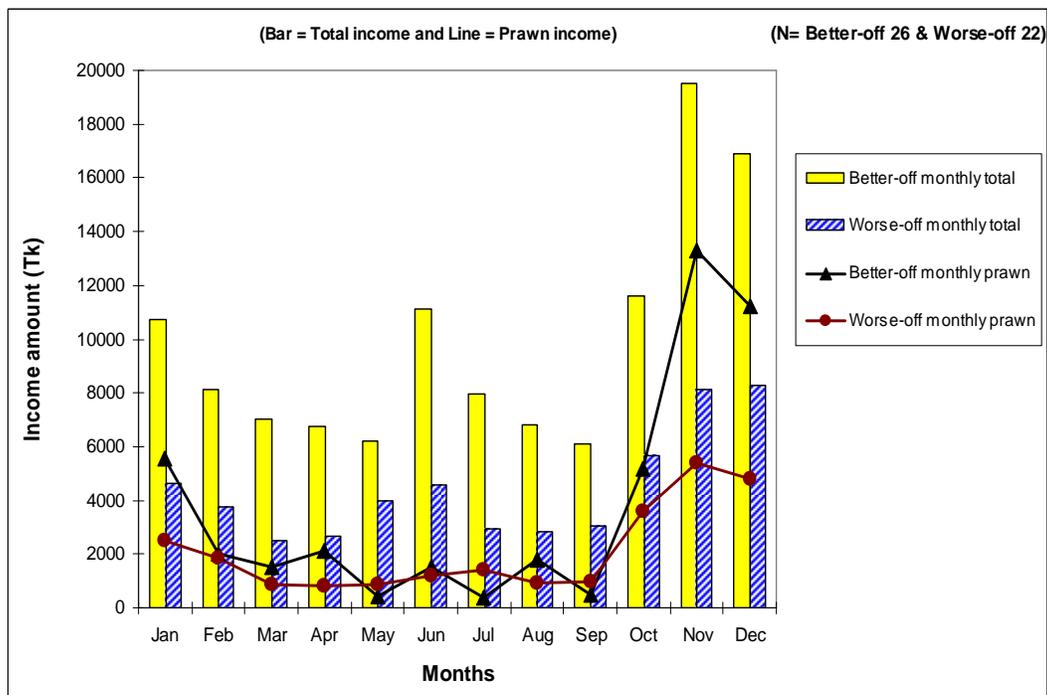


Figure 3.7: Monthly total household and prawn income by well-being

The monthly monitoring results (Figure 3.7) showed that total household income was related with income from prawn and there was a peak in income during November-December, which was the main harvesting period. The worse-off *gher* farmers harvested more frequently, averaging 6 times in a year and better-off farmers harvested 4 times a year (Figure 3.8).

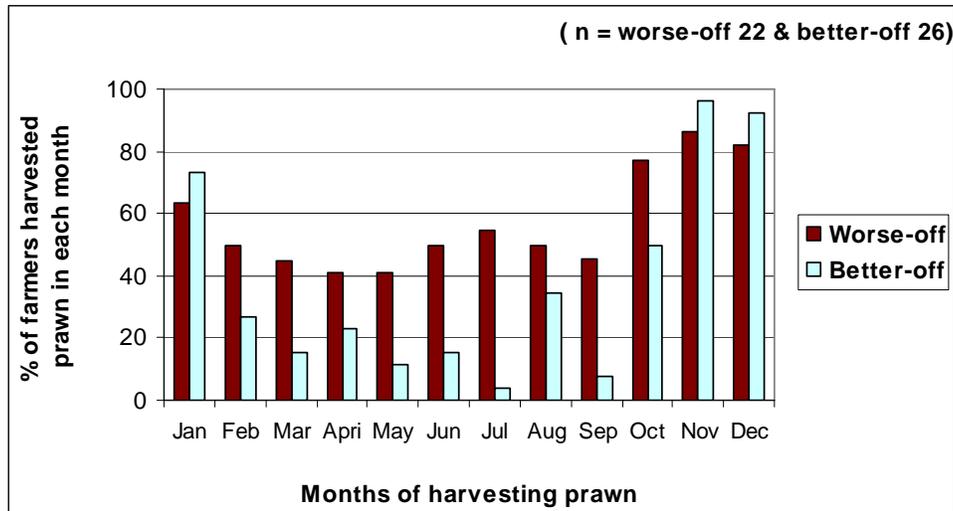


Figure 3.8: Percent of sample prawn farmers harvesting prawn in each month

Impact of *gher* farming on household food consumption

Monthly monitoring of food consumption showed that a major proportion of the main foods (rice, fish and vegetables) consumed by the farming households was sourced from the *gher*. The annual per capita fish consumption of *gher* farmers was 14.12 kg and there was no significant difference between worse-off and better-off farmers.

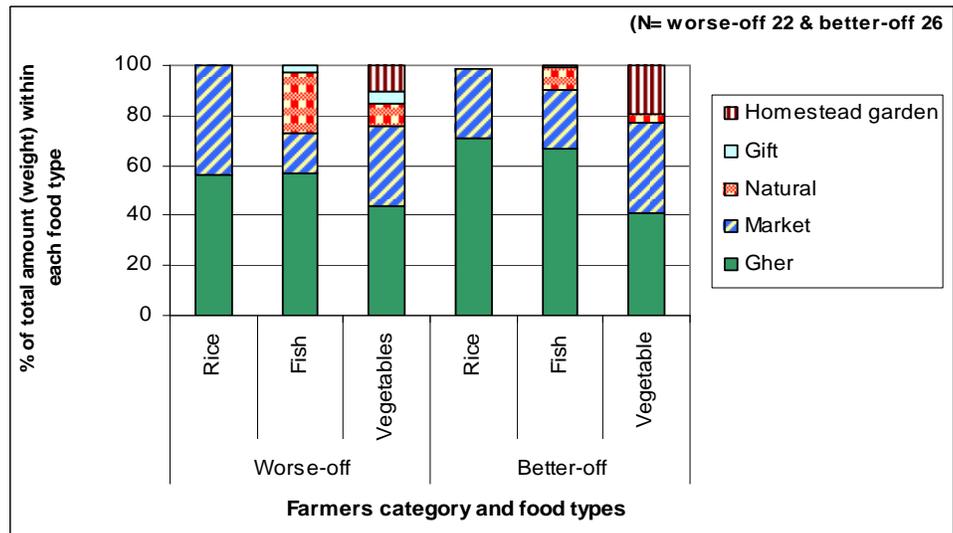


Figure 3.9: Source of rice, fish and vegetables consumed by farming households

The majority of prawn farming households in each village perceived their livelihoods had improved (better condition of basic needs; food, shelter, clothing, health and

education) over the last five years (Figure 3.10). There was no considerable difference in improving livelihoods between worse-off and better-off farmers.

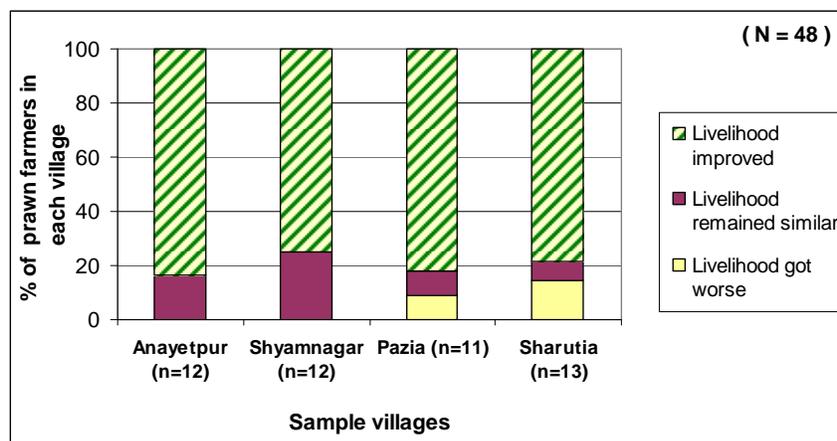


Figure 3.10: Livelihood changes of prawn farmers in Jessore over previous 5 years

Increases in household income was the main contributor to improved livelihoods. Several income sources and factors were found to contribute to household income. The factors that contributed to improving income were categorised and presented for worse-off and better-off farmers in Figure 3.11. Differences were observed in the factors that contributed to household income between worse-off and better-off farmers. “Increase of income from *gher*” through increased production due to improved practice and experience was the main factor for increasing income for both worse-off and better-off farmers.

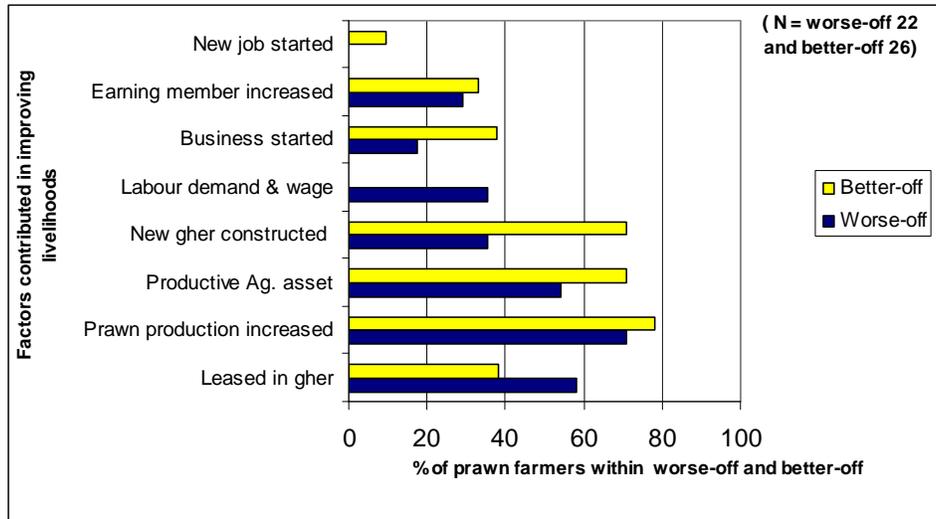


Figure 3.11: Factors contributed in improving livelihoods of prawn farmers

Farmers identified several livelihood outcomes that improved in their livelihoods (Figure 3.12). Differences were observed in outcomes between worse-off and better-off farmers. Improvement in food quality (74% farmers) and clothing (71%) were the most important livelihood improvements among worse-off farmers, while more than half (53%) mentioned that prawn farming had increased the average number of meals consumed over the last five years.

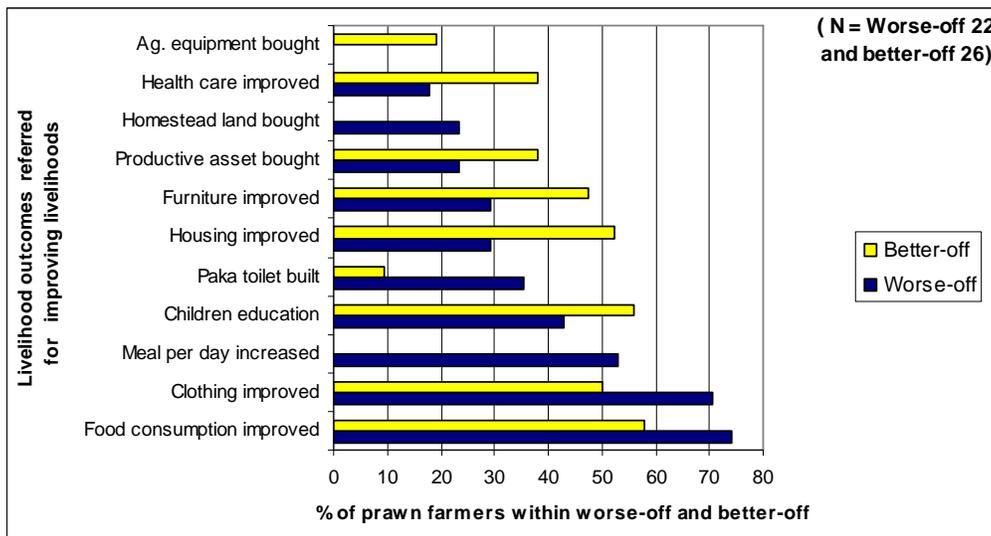


Figure 3.12: Livelihood outcomes for gher farmers

Social impact of *gher* farming

The social impacts of *gher* farming were found mostly positive. The main social changes identified by the farmers in FGDs are listed below (Table 3.5). Most of the changes were related with farming and others were related with increase of income. Farmers were found to guard their *ghers* in groups at night for prevent theft.

Table 3.5: Social impacts of *gher* farming

Sharing of labour and inputs prawn for production increased

Visiting relatives increased

Observing festivals in better manner (invite and gift)

Human mobility increased for *gher* inputs and marketing of products

Incidents of theft of households material and fruit and homestead vegetable reduced

Some incidents of quarrel among farmers due to *gher* farming were identified

Six incidents of poisoning *gher* were identified in four villages

3.3.1.2 Livelihood impacts on *gher* labourers

Several positive impacts of introducing integrated prawn farming on *gher* labourers were identified through four FGDs (one/village) (Table 3.6). The number of agricultural labourers varied widely among the sample villages depending upon the size and population of the villages and averaged 115 (± 57). Of the total agricultural labourers, 69% were employed full time or part time in *gher* farming activities. Most of the labourers (67%) parents were also agricultural labourers.

On-farm work opportunities for labourers engaged in prawn production had increased remarkably from 3.7 days/week to 5.8 days/week over the last 10 years in Jessore. At the same time the inflation adjusted daily labour wage had increased 30% from Taka 62 to Taka 81 for *gher* labourers. The wage payment in sample villages in Jessore included cash (Taka 81 at the time of study) and a meal during work (lunch) as part of the daily contract. However, the labour rates were found similar to other agricultural

activities. Many of the *gher* labourers (33%) were found to have started their own prawn farm by buying or leasing *ghers*, but they still worked as part time as labourers

Table 3.6: Impact of introduction of *gher* farming on labourers

Events	Village name				Mean (Std.)
	Shyamnagar	Anayetpur	Pazia	Sharutia	
Number of total labourers in villages	88	50	140	180	115 (±57.2)
Number of labourers work for <i>gher</i> farms	55	38	95	130	80 (±41.3)
Work opportunity 10 years ago (days/week)	4	4	4	3	3.7 (±0.5)
Current work opportunity (days/week)	6	6	6	5	5.75 (±0.5)
Labour wage 10 years ago (Taka /day)	62	62	62	62	62 (±0.08)
Current labour wage (taka /day)	80	85	80	80	81 (±0.11)
% of <i>gher</i> labourers becoming <i>gher</i> farmer (bought/leased)	29	45	33	27	33.3

[USD 1 = Taka 62, as used by Karin 2006: Amount weighted with inflation rate]

In the FGDs it was established that on average food consumption had improved (more quantity and protein) for 90 % labourers' households over the last 10 years. Clothing and housing also had improved (more and better quality clothing) for 80% labourers. Labourers often received fish as incentives in addition to daily wage contract (cash and meal) from prawn farmers when they were involved in harvesting prawn or fish, which comprised an estimated 29% of the fish consumed by their households (Figure 3.13).

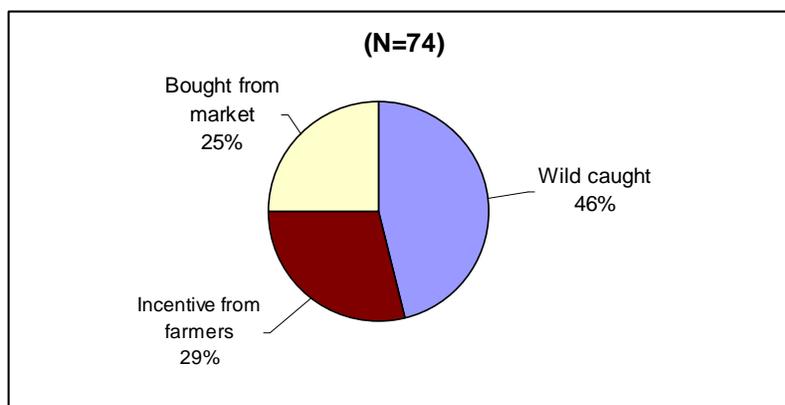


Figure 3.13: Source of fish consumed by *gher* labourers without *gher*

Before the introduction of *gher* farming labourers did not have adequate work opportunities for 4-5 months during the monsoon (July-September) as most agricultural land was flooded during period. Work opportunities in prawn farming had reduced the in lean period to about two months in a year. During these remaining two lean months (July-August) some labourers occasionally worked for *gher* operators and some involved in fishing in open waters and some others migrated to other areas for work.

3.3.1.3 Livelihood impact on fishers (prawn harvesting team)

Professional fishers were greatly impacted by the introduction and expansion of prawn farming and marketing. The result of there FGDs shows that 49% of the fishers had shifted their livelihood strategies since the introduction of *gher* farming and most of them (44% of total) were employed in prawn marketing in both forward and backward linkages (Figure 3.14). Some of them (6%) had established prawn *depo*.

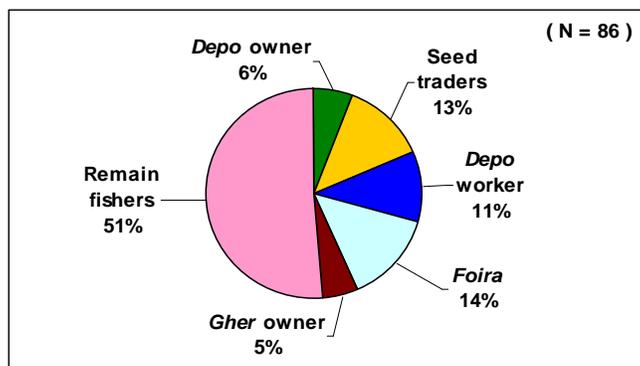


Figure 3.14: Change of occupation for fishers (%) with introduction of *gher* farming

The rest (51%) retained their profession as fishers and became involved in harvesting prawns in *ghers* along with catching wild fish in open waters. Opportunities for harvesting prawn had increased employment from 2.3 days/week to 6 days/week over the last 10 years with rapid expansion of prawn farming (Table 3.7).

Daily earnings among fishers had increased 46% from Taka 67 to Taka 98 (USD 1.59) (Table 3.7) over the same time. Results of FGDs with fishers show that food

consumption had been improved for 93% of the fishers, while clothing, health care and housing had been improved for 90%, 75% and 80% of fishers respectively (Table 3.7).

Table 3.7: Livelihood impacts of *gher* farming on fishers

Events	Anayetpur	Pazia	Sharutia
Number of full-time fishers involved in prawn harvesting	105	72	145
Work opportunity (days/week) with <i>gher</i> 10 years ago	6	6	6
Work opportunity (days/week) with <i>gher</i> at present	3	2	2
Current daily income (Taka)	100	95	100
Daily income (Taka) 10 years ago	62	70	70
Food consumption improved for (%) of fishers	95%	95%	90%
Clothing improved for (%) of fishers	90%	90%	90%
Housing improved for (%) of fishers	80%	85%	75%
Health care improved for (%) of fishers	80%	70%	75%

[USD 1 = Taka 62 and Taka adjusted with inflation]

3.3.2 Role of women in prawn farming and impacts on livelihoods

Following FGDs with women, 139 women were interviewed to gain individual perceptions on some selective aspects.

3.3.2.1 Women's role in prawn farming in *gher* system

Women from farming households were found to be carrying out several *gher* activities. All women from *gher* farming households were involved in prawn feed preparation while 76% of them fed prawns and 83% of them were involved in growing vegetables on *gher* dikes. Importantly, 35% of the women, mainly from the worse-off households, worked as substitutes for hired labour during harvest and some post harvest activities such as cleaning mud from prawn or fish, arranging harvested prawns in containers, and 32% were involved in repairing *gher* dikes when required (Figure 3.15). The majority of the women (77.6%) who were involved in netting *ghers* were also involved in repairing dike.

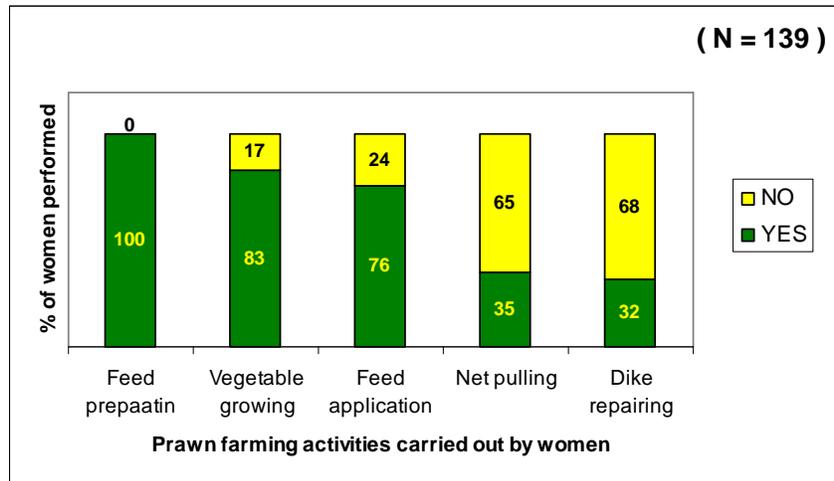


Figure 3.15: Prawn farming activities carried out by women

There were no remarkable differences among the villages regarding the roles of women in terms of different *gher* activities. The women were grouped in three age groups as A) ≤ 30 years of age, B) 31-40 years of age and C) > 40 years of age) to assess whether there was any relation of women's age with performing different *gher* activities. The analysis shows that more women from group B) were involved in harvesting and dike repairing than the other two age groups.

3.3.2.2 Time spent on *gher* activities and workload

On average the women spent 115 (± 36) minutes daily for *gher* activities which was 43% of total time spent (265 minutes) for agricultural activities and was significantly ($p < 0.001$) higher than the time spent for any other single agricultural activity. Of the total time spent on *gher* based activities, 51 minutes (44%) was used for prawn management and the rest (65%) was for growing vegetables (Figure 3.16). There were no significant difference between the villages regarding the time spent by women undertaking different agriculture activities as a whole.

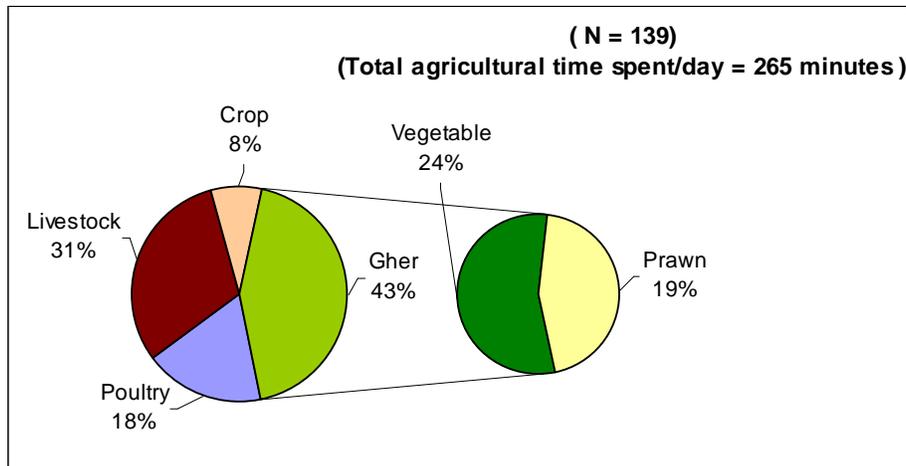


Figure 3.16: Time spent for different farming activities by women

Involvement with *gher* management activities increased workloads for women, but the majority of the women (81%) expressed their feelings that they were happy to carry out *gher* activities. The rest of the women (19%) expressed that they were not happy with the increase in workload considering their own situation. Regarding satisfaction with *gher* activities there were no remarkable difference among the villages.

There were a variety of reasons stated by the women for being happy to carry out *gher* activities even though workload increased. The reasons were categorised and are presented in Figure 3.17. There is significant difference ($p < 0.001$) among reasons stated by women for being satisfied. Thirty two percent of the women mentioned that they were satisfied because of “increases in income and food consumption particularly fish” for their households that resulted from their efforts. Fourteen percent women realised that they had to “work hard if there were to survive” and another 14% women perceived that they were “helping their husband” to improve the household livelihood. On the other hand, 19% of the women were not satisfied with increased workload mainly as they perceived that it negatively affected traditional activities and they “could not maintain household activities properly”.



Figure 3.17: Reasons for attitudes with increased workload associated with *gher* activities

3.3.2.3 Involvement of women in decision making process:

The study assessed womens' role in household decision making and found that the majority of women (79%) were consulted by their husbands regarding different *gher* activities and relevant matters and the rest (21%) did not feel that they had any active role in decision making through they carried out *gher* activities. Women were asked about the subject matter over which they had been consulted and they gave multiple answers. The answers are categorized and shown in Figure 3.18. Feeding prawns (50% women), stocking seed (47% women) and harvesting of prawn (50% women) were the most frequently discussed matters, which closely followed by selection of suitable dike crops and financial matters.

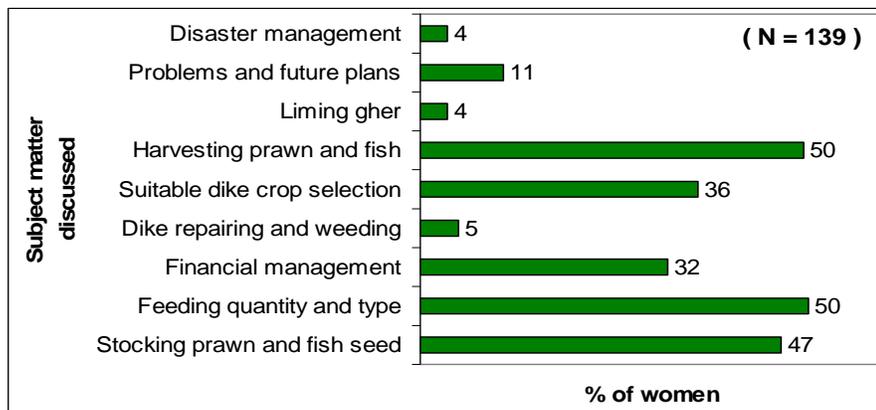


Figure 3.18: Subject matters discussed with women by their husbands

Women who were involved in *gher* activities were asked whether or not they could use some of the money earned from *gher* production with full freedom. The results (Figure 3.19) indicated that 56% women were involved in household financial decision making. The rest of the women (44%) realised that they did not have any active role in decision making on spending money. Women from 32% of households received some money to spend based on their own but their husband kept all the money, while in 12% households women kept the family money and they could spend some proportion of it. In 10% households, women were given money required for children’s care mainly for education. On the other hand in 20% households women kept the family money but could not spend without permission from husband.

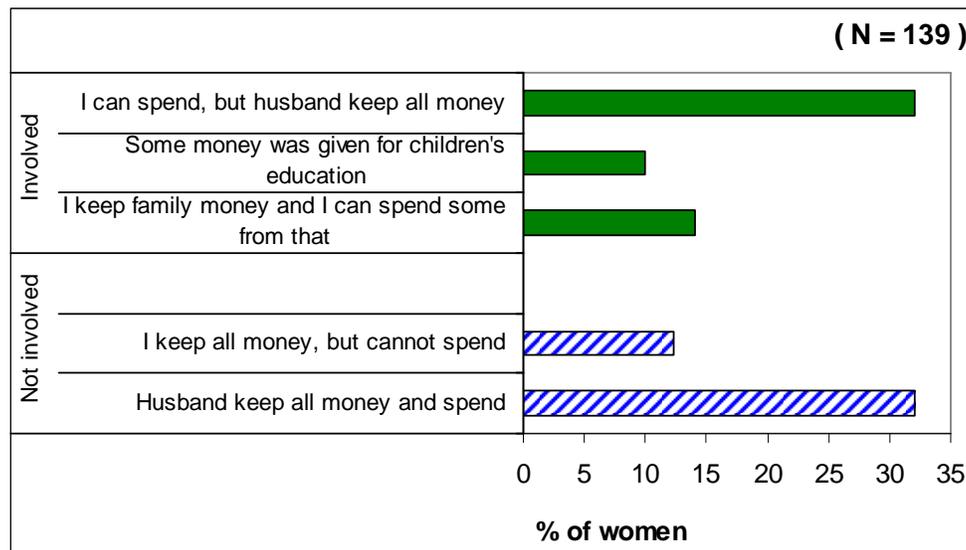


Figure 3.19: Womens involvement in household financial decision making

Women involved in *gher* farming were asked about their personal benefits from *gher* outputs. The results show that 33% women had more and better clothing and 14% were able to buy ornaments and the rest perceived that they were sharing benefits with other household members.

3.3.3 Prawn marketing in Jessore and impact on stakeholders

Freshwater prawn produced in Bangladesh is mostly exported and only a very small quantity is channelled to domestic retail markets. All the prawns produced in and around the study villages were found to be marketed for export. The study covered the activities and processes, actors in marketing chain up to processing factories and impacts on livelihoods. Figure 3.20 shows the different level of stakeholders involved in prawn production and marketing. The people involved in the marketing process and their responsibilities are given in Table 3.8.

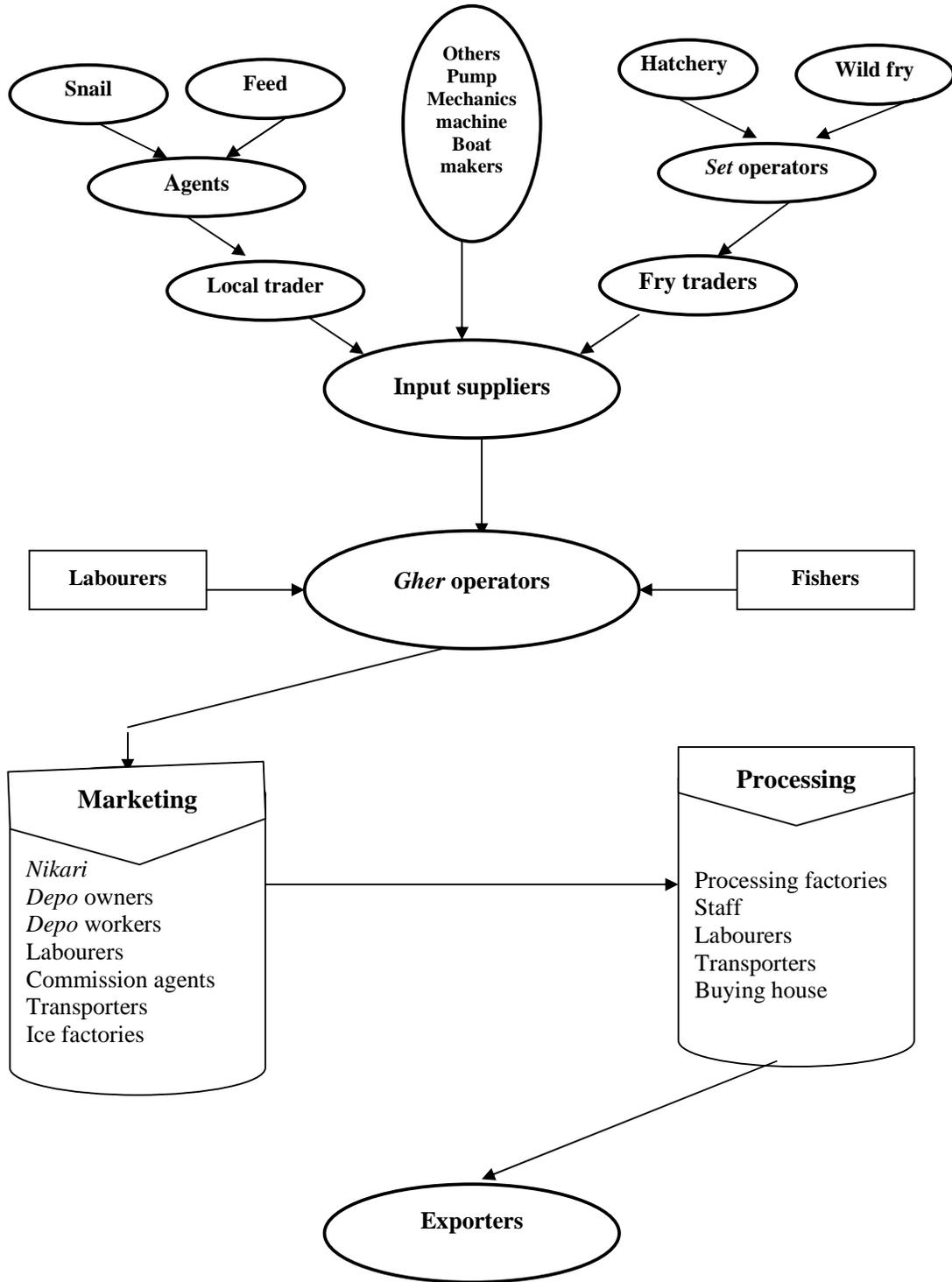


Figure 3.20: Stakeholders of freshwater prawn production and marketing

Table 3.8: People involved in prawn marketing chain and their main responsibilities

Stakeholder's position	Main responsibilities
Permanent labourers	They usually performed multiple activities as required and directed by the employer. The activities include loading, unloading, cleaning, weighing prawn, assist packing etc. Majority of the <i>depos</i> have such labourers for round the year termed as “permanent labour” in the thesis.
Seasonal labourers	In addition to permanent labourers most of the bigger <i>depos</i> hire labourers for the peak period of the business in a year termed as “seasonal labour”. The seasonal labourers work in others sectors as labourers, like agriculture, transport etc.
Packer	They are responsible for packaging prawn after grading and weighing. Most of the commission <i>depos</i> have packers. Packers also carry out other duties as required when packing is finished for a day.
Grader	They are responsible for grading the prawn. Many of the bigger <i>depos</i> have grader. In some <i>depos</i> graders also involve weighing prawn after grading. Owners of smaller <i>depos</i> themselves perform the grading and weighing.
Manager	They usually keep all written records of transactions regarding prawn and financial aspect. Mostly bigger <i>depos</i> have manager position otherwise <i>depo</i> owner do the job of manager i.e. keep all records.
<i>Depo</i> owners	<i>Depo</i> owners establish and run the <i>depos</i> in which they have invested.
<i>Depo</i> partner	Many of the <i>depos</i> established in partnership. Some of the very small <i>depos</i> are run only by the owner and partners.
<i>Set</i> owner	The prawn seed selling shops locally called as “ <i>set</i> ”. <i>Set</i> owners establish and run the <i>sets</i> which they have invested.

3.3.3.1 Prawn marketing chain, activities and processes

The marketing chain found through tracking same batch of prawn from the point of harvest up to processing factory gate is shown in Figure 3.21.

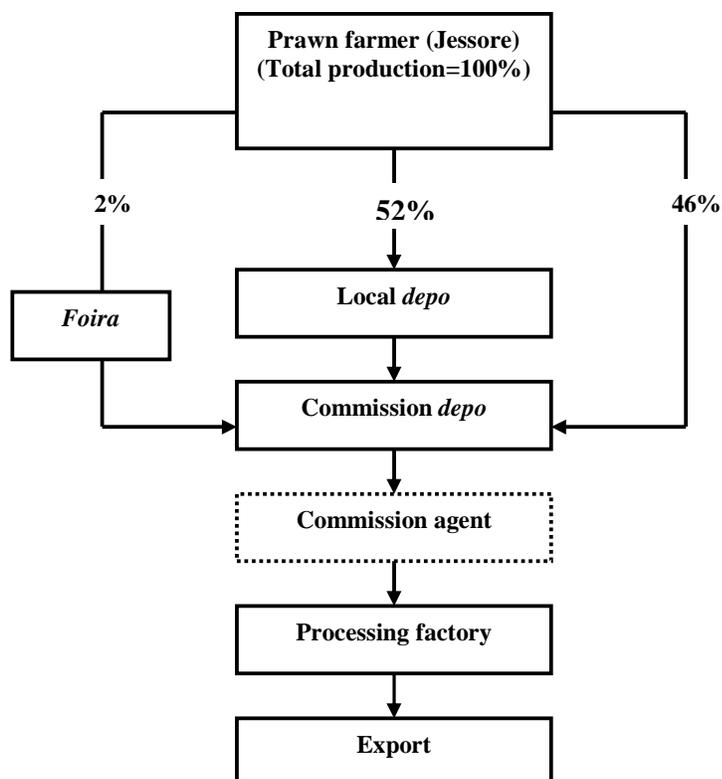


Figure 3.21: Prawn marketing chain within Bangladesh

Prawn farmers had two opportunities to sell prawns either i) at farm gate and/or ii) at *depos*. When farmers sold their prawns at the farm gate, the first task after harvesting was to grade the prawn according to their size. *Depo* people (employee or sometime *depo* owner) first graded the prawn and then farmers checked the grades. Usually there were some bargaining between the *depo* person and farmer regarding grade, but when both parties had agreed the grades, the prawns were weighed by local hand balance by the agreed grades. After that the prawns were quickly transported to *depo* and put on ice. ii) in the other case when farmers took the prawn to *depo* for selling,

first the prawns were immediately put on ice and kept for about an hour. Then framers had two options to either sell the prawns; head-on or head-off. In most cases farmers sold head-on. Prices were slightly more for head-off than head-on prawns. However, when the amount was high, it was not possible for farmers to remove prawn. The weight of prawns of different grades and price were recorded by the *depo* people and the farmers were given a receipt of the transaction.

Prawns were transported the next morning from local *depos* to commission *depo* by bus or van. Commission *depos* graded the prawn again using slightly different grades level than those used in local *depos* (Table 3.9). Once the commission *depo* agreed with the grades, prawns were weighed again and the amounts recorded by commission *depo* and the local *depo* is given a receipt of transaction. The commission *depos* maintain a separate record sheet for each transaction.

Table 3.9: Prawn grades used by local and commission *depos*

Grade= number in 1 kg of prawn	
Grades used by local <i>depos</i> for buying from farmers	Grades used by commission <i>depos</i> for buying from local <i>depos</i>
5	5
	8
10	10
	12
20	20
30	30
50	50

After grading, prawns are again immediately placed in bigger plastic containers with ice. Usually separate containers were used for different grades at commission *depos*. Once the containers were filled with prawn, these are sealed, tagged and labelled for identification. Commission agents provide transport (lorry) for commission *depos* to transport prawn to commission agents. Usually one big lorry follows a standard route and collects prawns from each commission *depo*. The commission agents have developed their own facilities to store prawns. Such agents may also check grades of the prawns.

A timeline established by tracking prawns (two times) from harvesting to the processing factory is outlined in Table 3.10.

Table 3.10: Timeline of prawn marketing (from harvesting to processing factories)

Activities	Distance (Km)	Time (24 hours)	Time (Hours)	Cumulative hours after harvest
Day 1				
Preparation and harvesting of prawn		11:00-14:00	3.0	
Selling prawns to local <i>depo</i>	1.0	14:00-16:00	2.0	2.0
Head-off prawns and stored at local <i>depo</i>	-	16:00-07:00 (next morning)	15.0	17.0
Day 2				
Transport to commission <i>depo</i>	7	08:00-08:30	0.5	17.5
Re-grading, repacking and storing at commission <i>depo</i>	-	09:30-11:00	1.5	19.0
Transport to commission agent	25	11:00-12:00	1.0	20.0
Checking grades and quality, packing and storing at commission agent	-	12:00-14:30	2.5	20.5
Transport to processing factories	45	14:30-16:00	1.5	21
Received by processing factories		16:00-17:00	1.0	22

Commission agents checked the grade and quality of prawn by observation of external appearance. When commission agent was satisfied with both grade and quality of prawns they prepared the prawns for delivering to the processing factories. Containers from different *depos* were grouped and tagged according to demand or order placed by different factories. Tags on the containers specifying the name of commission *depos*, grade, amount and price of prawn. The whole process in commission agents, from receiving prawns from commission *depos* to delivery to the processing factories took about 3-5 hours. Commission agents also kept records of all transactions of prawns. Commission agents supplied prawns to processing factories on a regular basis. Most freshwater prawn processing factories are situated in Khulna.

Farmers were usually paid partially or in full (if small amounts) immediately after transaction completed, with the balance being paid within 2-4 days. All payments

were made within 2-4 days for transactions of prawns. As *depos* had a regular supply of prawns, they received payments everyday for previous deliveries.

3.3.3.2 Farmers marketing

Farmers marketing practices were similar in the sample villages. Before harvesting prawn farmers usually checked the price offered by different *depos* and made a verbal agreement with one of the *depos* for prawn of different grades. As mentioned above farmers had two options for selling prawn to local *depos*; either farmer could carry the prawn to local *depo* after harvesting or local *depo* people could collect it from farm site or farmer's house. In the second case farmers needed to make agreement with local *depo* in advance. Farmers also sold directly to commission *depos* and in this case farmers could achieve a slightly higher rate than that of local *depos*'. Farmers mostly sold their prawn to nearer *depos*, whether it was local *depo* or commission *depo*. Farmers in two of the four sample villages sold most of their prawn (85% and 90%) to local *depos*, while farmers from the other two villages sold most of their harvest (80% and 85%) to commission *depos*. Sometimes, farmers harvested very small quantity of prawns and those were typically sold to *foira* at farm gate. This channel only constituted 2% of prawns traded. Most local *depos* were established along the main roads and adjacent to the prawn farming villages. In FGDs farmers explained that they sold small quantities (1-2 kg) of prawns to meet their daily living requirements. Even on the occasions that prices were low farmers had to sell prawns to meet their livelihood requirement. Most prawn farmers were not aware of the ultimate export market to which the prawns were sold or trends in demand, supply and price.

3.3.3.3 Employment in prawn local *depos* and commission *depos*

There were 30 *depos* at the market place where the farmers from the sample villages sold their prawns, of which 19 were local *depos* and 11 were commission *depos*. The

number of *depos* around the sample villages had increased over the years. The cumulative % of the number of *depos* established during 1993 -2003 is given in Figure 3.22.

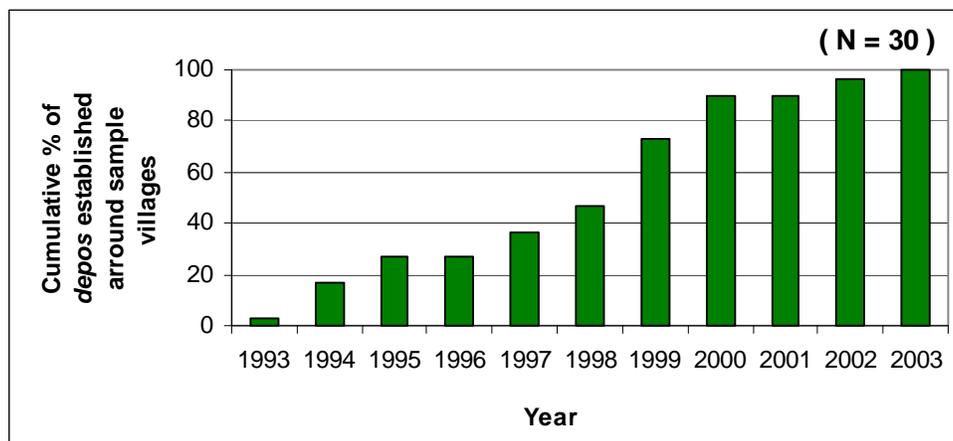


Figure 3.22: Trends in *depos* in the market place around the sample villages in Jessore

A total of 213 people were employed at 30 *depos* (mentioned above) including the *depo* owners and partners. The mean number of people working for local *depos* and commission *depos* was 6.33 (± 1.3) and 9.18 (± 2.9) respectively.

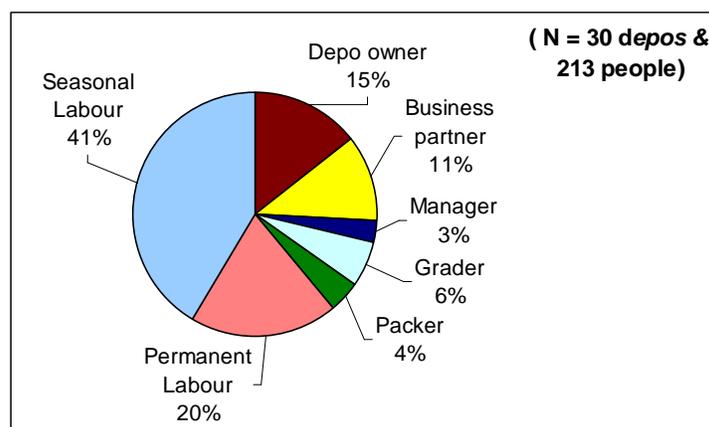


Figure 3.23: Proportion of different level of people worked in *depos* and sets

Figure 3.23 shows that poor people that had access to job opportunities in the marketing chain as seasonal labourers comprised the highest (41%) proportion among the employees followed by permanent labourers (20%). Considering the asset base shown in Table 3.11 it can be found that 71% of stakeholders including seasonal labourers, permanent labourers, packers and graders termed as “Employee” were very

poor. However, the number of employees for each *depos* depended on the amount of prawns handled and varied between 4 to 8 people for local *depos* and 5-16 for commission *depos*. Among the local *depos* five small *depos* did not have any permanent employees and were run by the owners and partners with seasonal labourers.

Table 3.11: Indicative asset profile of marketing stakeholders in two categories

Physical assets	Employees Mean \pm Stdev	Employers Mean \pm Stdev.
Family size	6.1 \pm 1.8	6.3 \pm 2.6
Household head age (years)	38.5 \pm 12.6	45.4 \pm 13.1
Education (5-12 class) %	33%	85%
Land holding (ha)	0.17 \pm 0.14	0.43 \pm 0.33
Cattle (number)	0.8 \pm 1.22	2.63 \pm 1.74
Goat (number)	1.14 \pm 1.4	1.20 \pm 2.10
Poultry (Chicken & duck) number	16.21 \pm 7.40	14.10 \pm 5.14

Interviews with intermediaries working at *depos* and *sets* indicated that intermediaries had been working within prawn marketing for an average of 5.3 (\pm 2.7) years. Of 186 sample stakeholders 116 (62.4%) started their career with prawn marketing since 2000 and 62 (33.3%) since 1995. The number of people working in prawn marketing chains had increased gradually between 1995 and 2004 (Figure 3.24).

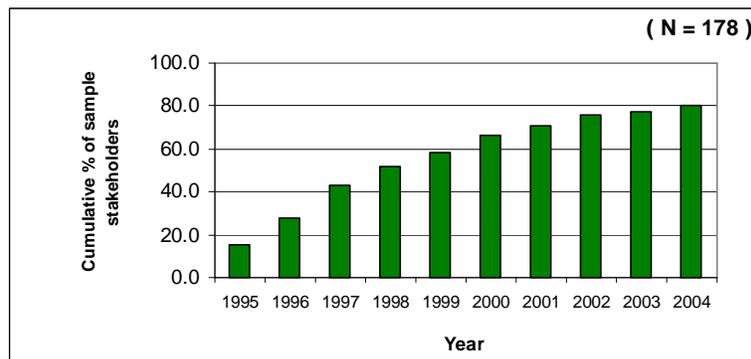


Figure 3.24: Cumulative % of prawn marketing stakeholders during 1995-2004

3.3.3.4 Access to job opportunities in prawn marketing:

Stakeholders working in prawn marketing had variable backgrounds (Figure 3.25). Figure 3.25 shows that 57% of the people working at *depo* and *sets* had different working backgrounds; while 30% changed their position within the prawn marketing chain and the rest (13%) started their employment with marketing.

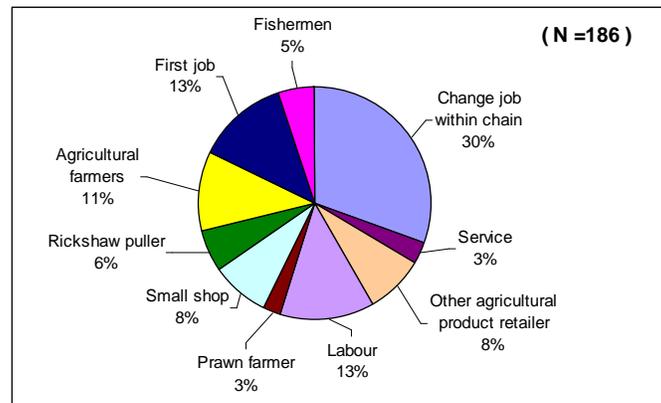


Figure 3.25: Last main employment for prawn marketing stakeholders

Labourers comprised the highest proportion (13%) among the people from different backgrounds other than prawn marketing, followed by farmers (11%) and retailers of other agricultural products such as vegetable, fruit, chicken etc (8%). The other 8% had experience in running a small grocery shop prior to their involvement with prawn marketing.

3.3.3.5 Reasons for seeking jobs in prawn marketing

There were a variety of reasons stated by the stakeholders for seeking employment in the prawn marketing chain i.e. changing their last job. The reasons were grouped under nine major categories and presented separately for employees (labourers, graders, packers, managers and, prawn and fish seed traders) and business owners (*depo* and *set* owners and partners) in Figure 3.26.

There was significant ($p < 0.001$) difference among the reasons for changing job. “More income than previous job” was found the main reason for changing job for 45% of the stakeholders, followed by the reason “work place closer to home” (18%).

Ten percent of the stakeholders stated that the compatibility of employment (“get time for other income and household activities”) with prawn marketing work with other income generating activities or household work was an important factor.

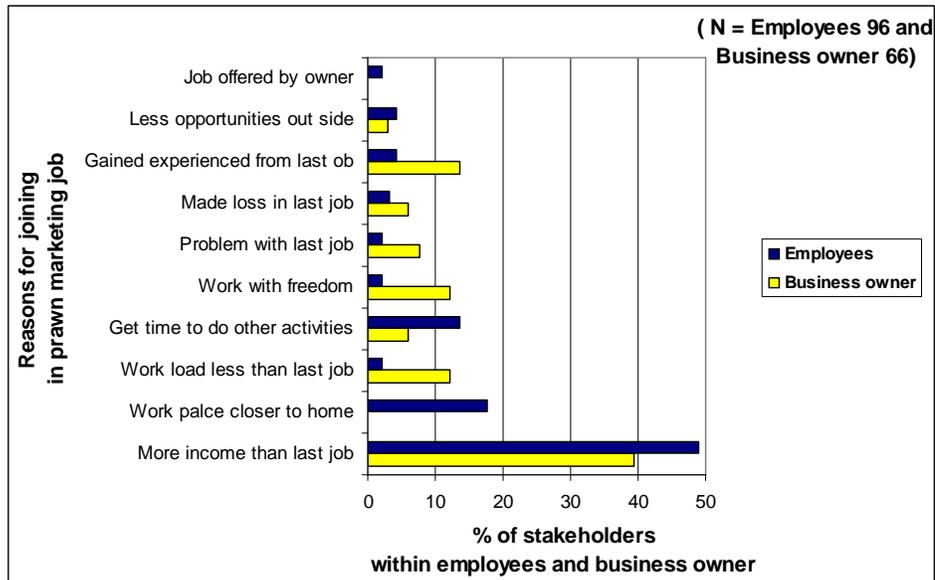


Figure 3.26: Reasons for seeking jobs in prawn marketing chain (i.e. changing last job)

3.3.3.6 Impacts of prawn marketing on livelihoods of stakeholders

The survey result showed that most stakeholders were pluriactive; only 21% were solely dependent on prawn marketing. The majority (74%) had two to three income sources and 5% had 4 income sources or more. However, income from prawn marketing contributed the highest proportion (71%) of the total household income for all stakeholders (Figure 3.27). The amount of income from prawn marketing was significantly higher ($p < 0.05$) than that from other sources.

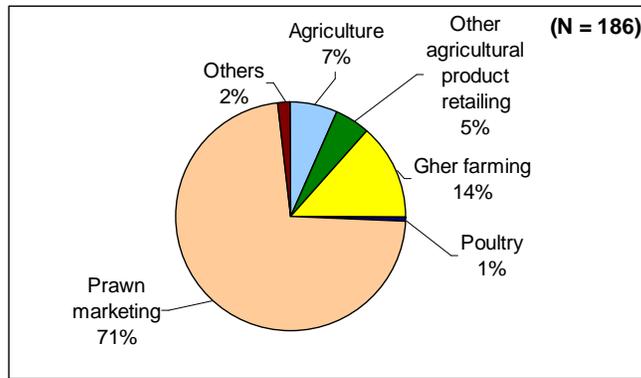


Figure 3.27: Proportion of household income from various sources for marketing stakeholders

To understand the income levels of different stakeholders at *depo* and *set*, employees and business owners were further divided into the following professional groups: employees were grouped in to three categories as i) fry traders (retail prawn and fish seed to farmers), ii) Labourers (Permanent and seasonal labourers working for *depos* and *sets* and iii) staff (*Depo* and *set* employees other than labourers such as managers, graders, packers etc.), while the business owners were divided into 2 as i) *Depo* owner and partner and v) *Set* owner and partner. The mean household income varied among the different professional groups in the marketing chain (Figure 3.28). The annual income of labourer's (USD 644) was lowest among the employees.

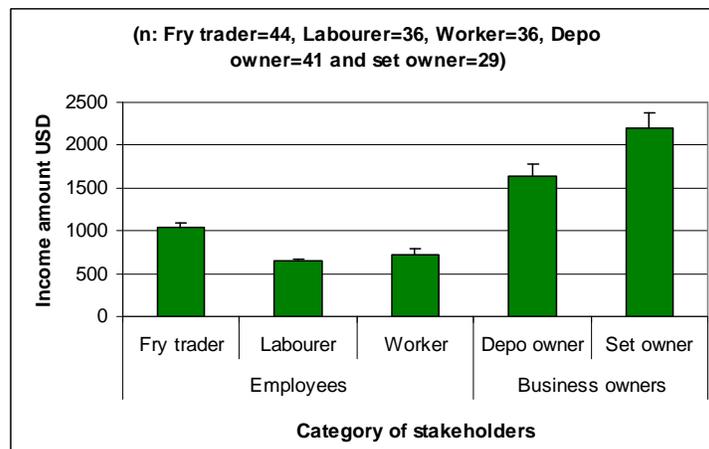


Figure 3.28: Mean annual household income for different level of marketing stakeholders

3.3.3.7 Improvement in livelihoods of marketing intermediaries

Sample stakeholders were qualitatively assessed regarding changes in household livelihood outcomes over the last 5 years and the factors influencing the changes. The responses of livelihood change are grouped into three; i) Improved, ii) Remained similar iii) deteriorated and shown in Figure 3.29 as employee and employer.

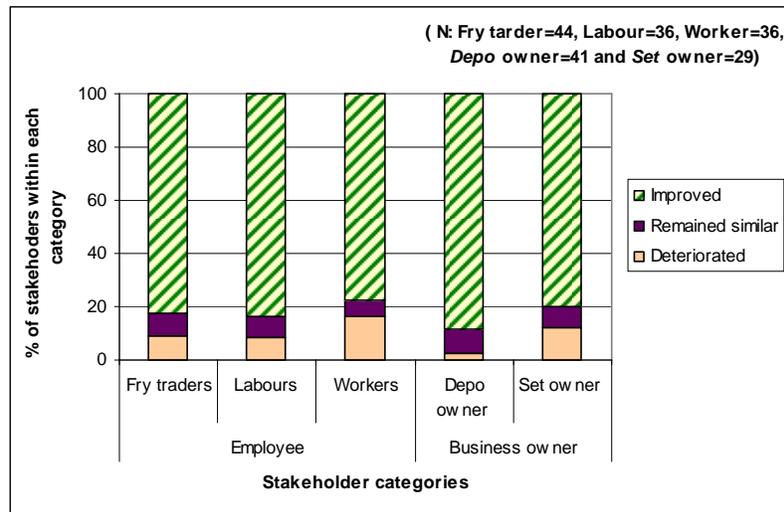


Figure 3.29: Change in livelihood over the previous 5 years for marketing intermediaries

Household livelihoods of the majority (82%) of marketing stakeholders were improved during the last five years; it was remained similar for 8% and got worse for 10% of the stakeholders. There was no remarkable difference among the different stakeholders groups regarding livelihood changes (Figure 3.29).

Increased income from multiple sources contributed to improving the livelihood of stakeholders, which are grouped into six main categories and was shown against different stakeholder groups in Table 3.12. Income from prawn marketing was the most important source (83% employees) contributing improving livelihoods of employees during the previous five years. This was followed by income from other “agricultural productive assets” (34%) such as land, livestock and water pumps that contributed to livelihood improvement. Buying or leasing in of *ghers* and income from those *ghers* appeared as the third most important source of income (29%

employees) that had led improved livelihoods for employees. Increased income from growth in existing business of (64% owners) was the most important factor contributing to improving livelihoods for business owners, which was followed by income from other agricultural resources (43%). Income from “establishing own *depos* or sets” (36% owners) was the third most important factor identified for improving livelihoods.

Table 3.12: Factors influencing improving income

Important factors influenced improving income	Percentage of response for each group				
	Employees			Business owners	
	Fry traders (n = 37)	Labours (n = 30)	Workers (n = 28)	<i>Depo</i> owner (n = 38)	Set owner (n = 20)
*Income from job/business	77	89	83	67	61
Bought productive asset and derived income	38	21	43	51	36
Bought or leased <i>gher</i> and derived	38	21	27	5	25
Increased earning of family member	7	10	11	0	0
*Started own new business	21	0	0	33	39

*All income from marketing chain but slightly different activities.

On the other hand the main causes for livelihood remained similar or deteriorated for all types of stakeholders (Table 3.13) did not show many differences.

Table 3.13: Factors influencing deteriorating livelihoods for intermediaries

	Remain similar (%) (n = 15)	Deteriorated (%) (n = 18)
Family member increased	13.3	11.1
Income decreased	0.0	16.7
Loss from business	26.7	16.7
Ill health-income declined	20.0	33.3
Income-salary same	20.0	0.0
Loss or sell of assets	20.0	22.2

The stakeholders mentioned multiple indicators (livelihood outcomes) to describe improvements in their livelihoods (Figure 3.30). Food (quality and quantity) and clothing was identified as important areas of improvement for the majority (70% and

68% respectively) of the stakeholders, followed by improved housing. Buying of productive assets was also referred as an indicator of livelihood improvement by 49% of stakeholders. However, there were significant ($p < 0.001$) differences among these indicators within and between employees and business owners. Among the outcomes (indicators) improvement of food and clothing was significantly higher ($p < 0.001$) than other indicators for employees (Figure 3.30).

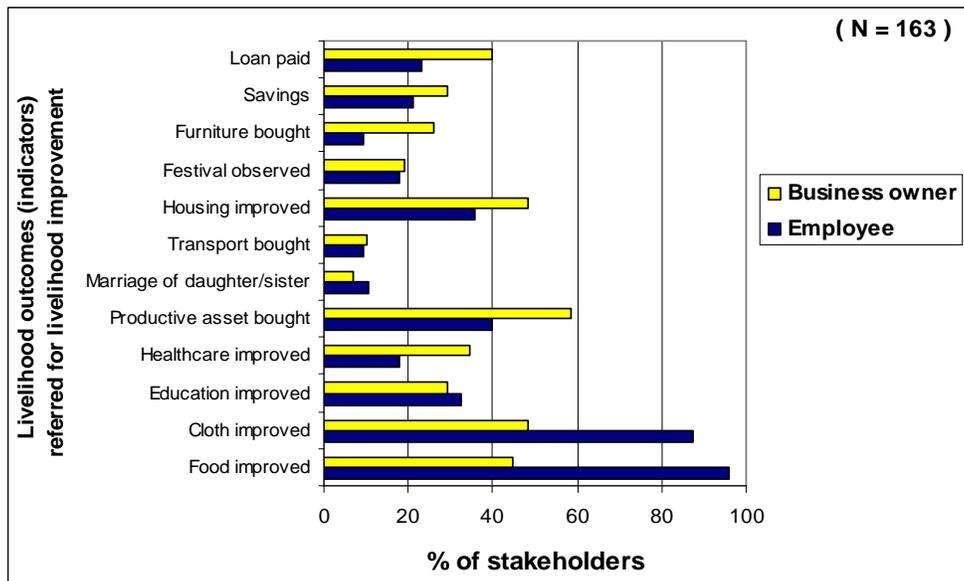


Figure 3.30: Livelihood outcomes (indicators) referred for livelihood improvements for marketing stakeholders

3.4 Discussion

Results obtained and presented in this chapter on freshwater prawn farming in *gher* system confirms that the introduction and rapid spread of freshwater prawn farming in *ghers* and marketing of prawns had significant impact on rural livelihoods in Jessore. The impacts were found to be diverse and varied among the stakeholders (Khatun, 2004). The impacts identified through the study are discussed below under three main sections;

3.4.1 Livelihood impact of *gher* production

3.4.1.1 Livelihood impact on prawn farmers

Introduction of prawn farming in *ghers* brought significant change in the agricultural farming systems in farming communities in Jessore and impacts on farming households. *Ghers* had been developed in low lying rice-fields, where farmers had previously grown only one rice crop per year. *Gher* development allowed the growth of multiple crops simultaneously and provided several livelihood benefits to farming households.

Gher farming, being a integrated production system, was found to be an important source of food for *gher* households. About three quarters of the farmers mentioned their food consumption improved mainly through the food sourced from *ghers*, while they also purchased more food from market with their increased income. The per-capita fish consumption of *gher* farming households was 14.12 kg/year and slightly more than 60% of the fish consumed by farmers' households, which was sourced from their *gher*. Various figures on per capita fish consumption were found in different studies (Boone and Kurtz, 1998). The Household Expenditure Survey (HES) for 2000 indicates that annual per capita fish consumption was 14.03 kg (BBS,

2001b). The mid term review of the Fifth Five Year Plan (Planning Commission, 2000) mentioned that the per capita per day fish consumption was 37.8 gm (13.79 kg per capita per year). Alam, (2002) found that annual per capita fish consumption for pond fish producers averaged 19.9 kg, while it was 13 kg for the poorer pond fish farmers.

The natural fish caught from the *beels* was found to be an important source of fish for worse-off farmers and constituted one fourth of the household consumption. Farmers mentioned that availability of natural fish reduced farmed fish consumption, thus increasing fish sold and income. Islam (2007) found that 26% of household fish consumed by fish farmers were sourced from natural stocks.

Similarly to fish, a large proportion (42%) of the vegetables consumed by prawn farming households were sourced from *gher* dikes. *Gher* farmers noticed that their vegetable consumption increased with introduction of *gher*. Similarly, Taher et al. (Undated) found that increase of farm vegetable production through the Helen Keller International interventions led to a 49% increase in vegetable consumption among women and children in one year (1999 to 2000).

However, the foods sourced from *ghers* were most critical to the livelihoods of worse-off farmers. The production of main foods, together with increased income from *gher* reduced their food vulnerability during the monsoon period by increasing the number of meals per day from two to three per day for half of the worse-off farmers. Islam (2007) found that seasonal variation in food consumption and income indicated food insecurity and the dimension of the vulnerability particularly of poorer households.

Household income was also found to increase from *gher* products. The mean annual income for *gher* farmers USD 1353 (Tk. 83808) found in the study was slightly higher than national income of USD 1168 (Tk. 70105) in 2000. A similar annual household income (USD 1232) found in a survey in 2000 conducted by the

Bangladesh Institute of Development Studies (BIDS) and International Rice Research Institute (IRRI) (BBS, 2004; Hossain, 2004b). The higher income of *gher* farmers can be attributed to mainly income from export oriented prawn production and increases in the prawn price over the last five years. However, household income varied widely with *gher* size and number of earning members of the households (Ahmed, 2001).

Income from *ghers*, were based on sale of prawn, fish, rice and vegetables, was found to be central to improving livelihoods of prawn farmers and comprised almost three quarters (69%) of the total household income for worse-off prawn farmers, of which more than half was contributed by sale of prawns. In a study on 400 prawn farmers in Bagherhat district Ahmed (2001) found that income from prawns ranged between 51%-54% of the total annual household income (average *gher* size 0.23 ha).

In general, increased household income contributed to the improved living status of farmers which included food, clothing, housing, and sanitation and child education. Demaine (2003) noted a similar observation among *gher* farmers in Noakhali district in Bangladesh. However, rural people are often found to invest their increased income and savings in both on-farm and non-farm activities, thus diversifying their incomes for greater livelihood security (Toufique and Turton, 2003; Ellis, 2000a). The majority of *gher* farmers were found to invest in the construction of new *ghers* (mainly better-off farmers), leased in *ghers* (mainly worse-off farmers), livestock, water pumps etc. or in non-farm income activities such as small grocery shops. Demaine (2003) found that the *gher* farmers from Noakhali district spent their increased income in business (16%), construction of new housing (15%), buying land (14%), releasing mortgaged land or repaying loans (13%), leasing in land/ponds (12%), buying poultry/livestock (12%), repairing old housing (11%), construction of new ponds/*ghers* (10%) and sanitation facilities (6%). The study revealed that all these productive investments were found to be important for improving income.

Income generation of farming households typically follows a seasonal pattern with crop cultivation and harvesting, therefore regular income flows can be critical for smoothing consumption, farm inputs and other daily requirements, particularly for poorer households (Devereux, 2001). *Gher* farming was a significant source regular cash to meet household expenses and risks (sudden illness of family members). The more frequent harvest of prawns by worse-off of farmers than better-off farmers, therefore, can be explained by their need for daily income to maintain their living. ADB (2005) reported that frequent harvest was practiced by 50% of the pond fish farmers in Kishoegonj, which was important for household consumption and income. Several studies have suggested that the most significant aspect of rearing scavenging poultry and cattle is to ensure smoothing consumption and income for rural households (Alam, 1997; Permin et al. 2000; Dorward and Poulton, 2001). Regular cash flow to households was also very important for repaying the credit instalments (weekly or biweekly) on loans from NGOs (Paris et al. 2004).

The study revealed that *gher* farming had significant impact on social relations. This can be divided into two main features. Firstly, it impacted positively on the interactions among the farmers. The farmers were found to guard *ghers* at night in groups to prevent prawn stealing and other vandalism. In addition, although it is not uncommon elsewhere in Bangladesh, farmers shared labour and other inputs like nets, water pumps, vegetables seeds etc. as well as farming experiences (Lewis and Mulvany, 1997; Saha, 2002a; Barrett, 2004). This increased unity and sharing was established by the farmers at group discussions. But the uniqueness was that that when other farmers assisted in harvesting prawns, they all were invited in dinner by farmer harvesting the crop. Secondly, an increase in social mobility was observed, linked to a need to ensure production inputs and marketing of farm products. More importantly, increased income helped the *gher* farmers to observe socio-cultural events generously including inviting friends and relatives to their homes and

exchanging gifts. These events and associated exchange of gifts improved relations among them and ultimately enhanced social security.

In contrast, farmers also reported in FGDs that there were some negative social consequences of increased interactions and sharing, resulting in quarrels/clash among the farmers. Incidences of poisoning of prawn and fish in *ghers* were reported by four farmers in two of the sample villages. Zaman (2000) noted a range of social problems associated with shrimp farming in Bagherhat, which included theft of *gher* products (50% farmers perceived), dike conflicts (sharing common dikes for vegetable cultivation and repairing common dikes) (52%) and increase in monetary conflict (46%). However, such conflicts in rural farming communities are not uncommon in Bangladeshi society (Ahmed et al. 1997; Rahman, 2002; Bates et al. 2004; Chowdhury, 2004). There are two conflicting traditions in Bangladesh peasant society, a tradition of participation and a tradition of patronage. The factors which commonly generate the conflicts are; multiple inheritance system with many heirs to an estate, individual property rights to land, scarcity of land and unequal distribution of land, scarcity of employment and other sources of livelihoods and need for political and physical protection (Rahman, 2002). Therefore, the social problem associated with *gher* farming communities are not different from other rural communities in Bangladesh.

While the benefits of shrimp and prawn farming in economic growth was confirmed, reported negative consequences of shrimp farming on the environment have also been documented for the south-western coastal area (Khulna, Bagherhat and Shatkhira) and many other Asian countries were (Zaman, 2000; Khatun, 2004; Primavera, 1997; Islam and Haque, 2004). The factors causing the major environmental problems involve destructive methods of fry collection, use of natural snail as shrimp and prawn feed and use of saline water for shrimp cultivation. The use of wild fry by farmers due to a shortage of hatchery fry and a preference for wild fry was associated with a loss of biodiversity in coastal and estuarine waters and demolition of mangroves (Islam

and Haque 2004). The destructive methods (fry collectors use very small mesh size nets for collecting shrimp fry, led to killing of aquatic fauna) used to harvest the post larvae pose a potential threat to other fish and shrimp fisheries in the ecologically important coastal nursery and feeding grounds especially in the Sunderban mangrove area. The by-catch in the Khulna area was reported to be as high as 145 billion per year and 40 billion in the south east (Cox's Bazar) area (Chantarasri, 1993; Khan, 2002).

The other cause for concern from an environmental standpoint was the use of snail meat as a prawn feed by farmers. The major species of snails (*Pila globosa*) have been collected extensively from wetlands in *gher* farming areas and neighbouring districts to meet the demand of a rapidly expanding prawn farming industry. Snail yields have declined in many water bodies due to diminishing stocks and every year new sites are exploited (Islam, 2001). In another study at Goakhola-Hatiara *beel* in Narail district (Sultana et al. 2001) found that snail (with shell) harvest declined from 3062 kg/person/year in 1998 to 1174 kg in 2001. However, the effect of this likely depletion of wild snail populations is not well understood due to a lack of knowledge on the ecological role of the snail in wetland systems (Williams and Najir, 2002).

Finally, the use of saline water in shrimp farming deteriorated environment by destroying many homestead fruit trees. The shrimp farmers in coastal areas drain saline water during high tides leading to an increased level of soil salinity, which caused damage of crop land and homestead forest and fruit trees. However, freshwater prawn farming does not require using saline water for grow out therefore such degradation of natural resources was not observed in Jessore. Furthermore, many of the problems associated with shrimp culture can be improved by farm-level good management practices (Béné, 2005). Improved management practices guideline, policies and regulations are needed to ensure for whole sector for long time sustainability (Kutty, 2005). Ensuring supply of prawn seed from hatcheries and formulation of low cost prawn feed would reduce dependency as well as destruction

of natural resources. Monitoring of quality natural resources has an important role to play in order to manage and maintain the resource and the economic performance of the prawn production system, if the above benefits are to be sustained (Alamgir et al. 2003; Williams and Corral, Undated).

Overall, a positive livelihood trend was emerged with the introduction of *gher* farming in Jessore. Three quarters of the farming households confirmed that the majority of basic livelihood outcomes had been improved over the previous five years through the involvement in *gher* farming.

3.4.1.2 Livelihood impact on *gher* labourers

Agricultural growth affects rural labour markets and the effects depend on the nature of the technology used. If the nature of technology is labour displacing i.e. uses machineries, herbicides, etc. that reduces demand for labour per hectare, while in general greater agricultural productivity is likely to boost the demand for farm labour either through expansion of farming area or intensification of farming (Irz et al. 2001). The introduction of prawn farming in *ghers* has had clear multiple positive impacts on wage labour markets, particularly *gher* labourers in Jessore. The rapid expansion of prawn farming has increased the demand for labour and created new on-farm livelihood opportunities for agricultural labourers over the last 10 years. Hayami and Ruttan (1985) reviewed the literature on the effect of modern rice and wheat varieties in Asia to conclude that their introduction increased the labour requirement per unit of land and increased employment. In the initial stage of green revolution technologies boosted labour demand for per unit of land by 20%, but later slowly eroded owing to the subsequent adoption of labour-replacing inputs such as tractor, threshing machine, herbicides etc. (Lipton and Longhurst, 1989). However, level of labour demand largely depends on input use and intensity of farming (Irz et al. 2001). The study found that the overall number of working days for labourers with *gher* activities had increased remarkably from 3 days/week to 6 days/week over the last 10 years. Studies

have shown that the take up of commercial agriculture can have dramatic effects of agricultural labourers. Weinberger and Genova (2005) found that commercialization of vegetable production in Jessore Sahdar thana and Saver thana in Dhaka increased hired labour use by 98% among vegetable farmers. Von Braun (1994) found an increase in the use of hired labourers due to commercialization of agriculture in the Philippines (from 36% to 63%) and in Guatemala (from 21% to 26%).

The study found that the increase of labour demand and employment opportunities led a structural shift within the agricultural labour force. The majority of the agricultural labourers (69%) were found to become employed on a full-time or part-time in *gher* farming activities.

Increase in labour demand, driven by agricultural growth is also likely to affect labour wage (Irz et al. 2001). As long as labour supply is less than perfectly elastic, such changes in labour demand will increase wage rates in local labour markets (Renkow, 2000). As a result of increased demand for hired labour the real daily labour wage increased by about 30% (to Taka. 81, USD1.3) over the last 10 years. A 1.3 to 2.8 times real labour wage increase was observed in Central Luzon during Green revolution (1966 -1194) (Estudillo and Otsuka, 1999).

Seasonal variation in agricultural farming and employment causes seasonal vulnerability of agricultural labourers. Therefore seasonal migration of labourers for employment is a common practice in many areas of Bangladesh (Toufique, 2001). The study found that the work opportunities in *gher* farming in Jessore greatly reduced the vulnerable period for labourers. Before the introduction of *gher* farming in Jessore labourers in prawn farming communities were mostly unemployed for about five months during the monsoon, which was reduced to two months through the employment in *gher*. However, labourers also occasionally worked for *gher* during this two months and rest of the time they either caught wild fish from open waters, sought other employment or remained unemployed .

The benefit of prawn farming in *ghers*, other than employment generated, included receipt of fresh fish (200-300/week g), when employed for harvesting *ghers*. Although the quantity of such incentive fish was small, it comprised about one fourth of the total household fish consumption of labourers. Gifting or exchange of agricultural products for households' consumption is a socio-cultural custom in farming communities in Bangladesh (Ali and Niehof, 2005). Islam (2007) noted that giving fish as a gift is common in the rural community, particularly during the monsoon when wild fish are available. He found that such gifted fish comprised 21% of the wild caught fish consumed by fish farming households. *Gher* labourers were also found to buy fresh vegetables (*gher* dike vegetables) from prawn farmers at slightly lower prices than in the market, which was a clear evidence of multiple positive impacts of integrated prawn farming on labourers' households.

Leasing agricultural land and sharecropping is a traditional practice in farming communities in Bangladesh (Weinberger and Genova, 2005). About one fifth of the total arable land of the country is under some kind of tenancy (Ahsan and Ahmed, 2003). This opportunity had aided many *gher* labourers to become *gher* operators. Their working experience as labourers has encouraged them to lease in *ghers* either individually or in groups (Zaman, 2000). Thus one third of the *gher* labourers were found to become prawn producers. However, on the same scale they remained working as part-time labourers as their *gher* operations were not large enough to employ them full-time. Operating their own *gher* was found to be significant, not only in increasing their income but also by increasing their interactions with other *gher* farmers and improved social status. In Bangladeshi society improvement in social status enhances social safety nets and reduces short term vulnerability, as people can seek help or borrow money from others to cope with short term risks and requirements.

In contrast, studies conducted on shrimp farming in the coastal region (Bagherhat, Shathkira and Khulna) found that shrimp farming, though generating significant

livelihoods for labourers, also had impacted negatively on local *gher* labourers (Zaman, 2000; Khatun, 2004). In many cases local labourers involved in the coastal areas were reported to be replaced by labourers from outside of the farming communities by the *gher* owners from outside of the community and local labourers had become more vulnerable than the past. This was due to changes in the land ownership and social power structure in farming communities (Alauddin and Hamid, 1999; Béné, 2005) However, such change in land ownership and social power structure was not identified in the current study in Jessore district. This may be due to i) prawn farming was relatively recent in Jessore compare to the coastal area and ii) social bonding and fabric, and local power structure was different in Jessore compared to the coastal area. Although *gher* labourers experienced both positive and negative impacts in the coastal areas, the employment generated at the shrimp production was found to be very crucial, particularly in a highly populated country like Bangladesh. Therefore, socio-economic changes, particularly land ownership and social power structure should be monitored carefully so that such employment opportunities are generated and sustained to benefit the welfare for local labourers (Alamgir et al. 2003). This is because the study established that the multiple benefits from introduction and expansion of integrated *gher* farming improved overall household livelihood outcomes of labourers remarkably, particularly in food consumption, clothing and housing for the vast majority of *gher* labourers.

3.4.1.3 Livelihood impact on fishers

Fishing communities are an important group of landless people with incomes corresponding to absolute poverty level and a marginalised stratum of society (IFAD 2004). Professional fishers are often in vulnerable condition due to increasing population and decline of catches form open waters (Sultana and Thompson, 2000; Rahman et al. 2002).

In many cases fishers have suffered from conflicts associated with access to a control of natural water bodies. It is argued that inequality in livelihood assets among the user groups might be associated with different degrees of control and access of the fisheries resources (Toufique, 1998). However, the professional fishers sampled in the current study those that used to depend on catching wild fish in the *beels* (natural depressions) have been significantly impacted by freshwater prawn production and marketing.

Diversification of livelihoods was the central of the impacts of the prawn sector on fishers. Diversification of livelihoods has been associated with “necessity” or “choice, sometimes considered as being a contrast between “survival” and “choice” (Ellis 2000a). In the context of an increased number of fishers within the fishers’ communities by population growth and declines in wild catches due to reduction of natural fish stocks, it became a question of survival for fishers. Therefore, diversification of livelihoods for fishers in this case was probably more “necessity”. Diversification of livelihoods within the fisheries sector is perhaps the most realistic way of reducing dependency on only fishing and vulnerability for fishers. The growing prawn sector has opened such windows for diversifying their livelihoods for fishers in Jessore district.

The study revealed that almost half of the professional fishers had changed their profession over the last 10 years. The majority of them were now employed in prawn marketing both in forward and backward linkages (prawn and fish seed trading, feed supply etc). Utilising their skill and experiences of fishing and fish handling, many of the fishers became prawn and fish seed traders (13%) and workers (11%) at *depos* and sets. Some of them who established *depo* businesses (owner) became truly rich. Such livelihood diversification has also been observed in fishers’ communities in Southeast Asia. Poor fishers in Indonesia and the Philippines culture molluscs and seaweeds. Small-scale farmers dominate shrimp farming in Thailand, a majority of whom were previously either rice farmers or fishers (Edwards, 2002). There are many examples of

the promotion of alternative livelihoods for coastal small-scale fishers, introduction of various forms of mariculture aimed to raise alternative incomes for poor fishers and coastal communities, which also reduced fishing pressure and the destruction of resources (SDP, 2002). Seaweed cultivation in Indonesia, Philippine and Vietnam was also found to reduce income poverty and to improve the living standard of poor professional fishers and coastal people as an alternative livelihood (Ask, 1999; Ellis, 2001; Leila et al. 2005).

On the other hand, half of the fishers who retained their profession were also benefited significantly through employment in harvesting *ghers* in two ways; firstly, shifting profession by half of the fishers as mentioned above reduced the competition among the fishers for employment and secondly, the rapid expansion of prawn farming further increased demand for fishers for harvesting prawn. As a result employment opportunities increased significantly as reflected in the increase of the number of harvest days (per week). The harvest opportunities in *gher* had been increased to 6 days from 2 days during the last 10 years. The increase of *gher* harvesting opportunities also increased wage rate (contract rate for harvesting) i.e. daily income by 46% to Taka 98 from Taka 67 over the previous 10 years.

Traditionally, fisher communities have less interaction with other communities, but in many cases social interaction and networks play important roles in gaining access to natural resources for fishers (Thompson et al. 2000; Islam et al. 2006). Involvement in *gher* farming had afforded opportunities for fishers to interact with prawn farmers and *depo* owners. The *depo* owners (both local and commission *depo* owners) acted as a middlemen between fisher and prawn farmers for the contract.

The ultimate benefits of above positive impacts of *gher* farming had been confirmed through the improvements of several livelihood outcomes. The increased employment opportunities and income resulted in remarkable improvement in food consumption, clothing, health care and child education for the majority (>80%) of fishers.

3.4.2 Role of women in *gher* farming and impacts on women

Involvement of women directly and indirectly in fisheries and aquaculture is an age old practice in many Asian and African countries. Women perform a range of activities throughout the value chain of aquatic food products (Kevane and Wydick, 1999; Shaleesha and Stanley, 2000). These activities includes fry collection from the nature, induced breeding hatcheries, grow-out production and management, on farm and on shore post-harvest activities, marketing of products and processing of fisheries products (Sharma, 2003; Song, 1999).

While in Bangladesh, rural women are traditionally restricted within households by socio-cultural and religious boundaries commonly termed as “*purdha*” and are expected not to move outside the homestead. The seclusion of women by *purdha* has been noted as the main factor constraining women’s participation in income earning activities reinforcing the inferior position compared to men (Barman, 2001). In a broader sense, *purdha* involves the exclusion of women from the public male sphere of economic, social and political life (Chen, 1990). However, women are traditionally involved in various agricultural activities including poultry, livestock rearing and vegetable production that do not require movement outside the homestead (Hamid and Alauddin, 1998; Shelly and Costa, Undated). With the changing socio-cultural condition women’s participation in agricultural production systems in Bangladesh has been started to shift from household based farming activities to labour intensive farming systems (Shelly, 2005). Prawn farming in *gher* in Jessore was found to have opened a unique window for women to come out from the homestead to work at farm as substitutes for paid labour that is increasingly expensive and unavailable during peak harvesting time (Hamid and Alauddin, 1998).

The study investigated three aspects of the role of women in integrated prawn farming; i) the activities they performed, ii) the time pent for performing those activities and ii) the workload. Almost all women from poor and middle class prawn farming households were found to be involved in prawn feed preparation, applying

feed and growing dike vegetables. No considerable difference across the villages indicated that it had become a common phenomenon in the prawn farming communities, particularly growing vegetables. Some women commented that those activities became “women’s activities”. Rahman (2000) studied the impact of commercial vegetable production in Bangladesh and found that women’s participation in vegetable production in terms of labour hour was high (47%) and *higher* than other for conventional food grain production (ranged between 11 and 18%). In China women carry out a range of aquaculture activities which includes the majority of the tasks of production, post-harvest activities, transportation, processing and marketing of aquaculture products. Thus, they constitute more than one third of the aquaculture employments (Song 1999). Women’s participation in aquaculture in Lao PDR is also very high, while trading of aquaculture products is exclusive to women as buyers, sellers and middle-women in Srilanka (Murry et al. 1998).

The study revealed that one third of the women, mainly from worse-off *gher* farming households clearly demonstrated that they could perform hard manual activities like netting of *ghers* for prawn harvesting and repairing dikes. To save money on hired labour was the main motivation of carrying out those activities. This was a necessity for making a living rather than choice for worse-off households. Similarly, many poorer women in other developing countries, like in Vietnam, carry out most integrated farming management tasks (Voeten and Ottens, 1997). Through the study found no remarkable difference in the proportion of women performing harvesting and repairing dikes among the villages, distinct age difference was found among the women in this regard. The majority of women performing net pulling and dike repairing were aged from 31 to 40 years, while older women were probably less capable to do hard physical activities and younger women were more restricted by *purdha* norms.

To carry out the above prawn farming activities women spent about 2 hours daily, with more than half of the time spent for growing vegetables and the rest was for

rearing prawns. This may be attributed to the conventional roles of women growing vegetables. Upadhyay (2005) reported that 88% of activities of growing commercial vegetables were carried out by women in India, Nepal and Srilanka. However, spending more time on *gher* activities (43% of total time) compared to other individual agricultural activities clearly indicates that *gher* outputs were very important for households and there were no major constraints to being involved in these farming activities.

While introduction of *gher* farming increased the active participation of women in farming systems, this resulted to poor households; women from richer farming households did not become involved in farming activities. A combination of three main factors can explain this; firstly rural society views are that women working in the field reduces social status of households; secondly it indicated that the household is disobeying *purdha* norms and finally women working in agriculture farms indicates that their households do not have enough money to employ labour.

In general, women's involvement in farming increases their overall workload (Upadhyay, 2005). The women described *gher* activities as an addition to their previous normal daily duties. A study of five DFID fisheries projects (Halim and Ahmed, 2003) found that 43% of the women involved in project activities worked for 2-4 daily hours, 17% worked more than 4 hours and 34% less than 2 hours daily. However, they further noted that despite women's involvement in the fish production related activities outside the house, they still had to carry out their routine household chores and that failure to prepare meals on time led their husbands harassing them. Williams et al. (Undated) notes that the change in gender relations that occurred as a result of increased involvement of women in economically productive activities of *gher* farming was accompanied by a rise in their workload. The study assessed the feeling of women involved in *gher* activities and found that the majority of women (80%) were happy carrying out *gher* activities considering the overall outcomes from *gher* system and benefit to households, of which increase of income and improvement

in food consumption, particularly fish consumption were considered as the most important. While, some women were found to perceive that they were helping their husband to increase household income. Many women themselves tend to undervalue their own work and contribution (Sharma, 2003). However, notably, the women, mostly from the poor farming households realised that their involvement was by a necessity rather the choice.

Though prawn farming in *gher* farming benefited household livelihoods, still some of women (20%) expressed overall negative impression about the increase of workload due to *gher* activities mainly for two reasons; neglected of children's care and resulting poor health condition. Women in Bangladesh, in general, are fully responsible to take care of children (Parveen and Leonhäuser, 2004). Hamid and Alauddin (1998) found that greater involvement of women in shrimp culture in Bagherhat and Khulna forced them to stay outside of the home longer, which limited their time for household duties, more specifically looking after children. On the other hand, in general the women in rural society are deprived of healthcare and nutrition (Quisumbing et al. 2001; Parveen and Leonhäuser, 2004). Notably adult and infant mortality rates differ more widely across males and females (Sen, 1998).

Although aquaculture provided opportunity to the women to become involved in major production systems, benefits for women and empowerment within household and in society need to be further improved (APEC, 2001). The study explored the outcomes and benefits gained by the women involved in integrated prawn production and found that overall, women's empowerment was enhanced to some extent.

Performing *gher* farming activities certainly increased women's involvement in decision making, particularly about *gher* activities for the majority of women (80%). In a study on the 235 women participants of CARE GOLDA project in Bagherhat and Khulna districts, Zaman (2000) found that active participation in *gher* farming increased involvement in household decision making for 80% of the participants.

Feeding prawn and fish, stocking of seed, and harvesting of prawn and fish as well as growing vegetables, were the most frequently discussed matters found in the current study. This can be linked to their active participation in those activities. While, preparation of fish-prawn feed and feeding can be attributed to the traditional women's practice of rearing poultry and decision for growing some vegetables for home consumption (Paul and Saadullah, 1991; Khan et al. 2006). Zaman (2000) noted some other factors that enhanced women's decision making. She found that 37% of women mentioned their decision making improved through NGOs (credit and saving scheme), 15% through media and 4% by improving education.

Farm financial matters were fairly frequently discussed with women by their husband. When there was a need for money in many cases, women were consulted about ideas to organize money. Furthermore, in many cases husbands had to discuss and to get agreement from wives for taking loans from NGOs as many NGOs provided loans only to women (World Bank, 1998; Amin et al. 1996).

Hamid and Alauddin (1998) found that by becoming active earning member in rural households women have risen to the position of decision makers in their day-to-day business. They have also been enjoying more buying power and thereby more access to food and clothing, and in some cases to some luxury goods. (Islam, 2005) reports that women's decision making had improved as a direct impact of participation in NGOs advocacy and awareness building programmes in Rajshahi, Naogaon and Chapai Nowabgonj district in Bangladesh.

The study found that half of the women were involved in household financial decision making, of which one third could spend some money on their own with full freedom, especially when prawns were harvested in large quantities. But in the majority of cases they needed to consult with their husband, as males mainly controlled household expenditure. In contrast, the other half of the women did not have any real involvement in household expenditure, although some of them (12%) kept the

household money. Zaman (2000) reported involvement of women in prawn farming through CARE, GOLDA project had increased women's financial decision making. She found that 47% of the women were able to buy their clothing, 28% involved in children's education expenditure and 9% of women were involved in children's marriage expenditure. Although women in the present study had limited access to direct expenditure, they expressed that they were often consulted about the household expenditure. However, the change in the economic status of women tended to be reflected in improvements to the social status of women with likely generational benefits for daughters (Finan et al. 2001). Therefore, it can be concluded that *gher* farming not only improved women's productive role but also enhanced their empowerment in production and financial decision making. These change in the decision making enhanced their social status.

3.4.3 Prawn marketing in Jessore and impact on stakeholders

Bangladesh exporting of prawns began and shrimp in the 1970s and volumes have been gradually increasing since this time. Since the 1990s international demand and trade in sea food, particularly shrimp has increased rapidly, which led the boost of the industry including local production, marketing and processing in Bangladesh (Alauddin and Hamid, 1999). The sector, including marketing and exporting of prawn has mostly developed and expanded through the private sector. The government has provided support to exporters in the form of subsidy (10% of the export money), reducing tariffs (less port cost and export tax) and providing quality certification (Khatun, 2004). Development and issues of marketing and processing did not attract much attention in either the government or the private sector until the European Union (EU) banned prawn import from Bangladesh in 1997. The ban was related to quality failure in respect of HACCAP (Rahman, 2001). Although, the ban was withdrawn after 6 months, it has left behind many consequences in terms of improved awareness and "rethinking" of marketing and the quality control. The study focused on the existing freshwater prawn marketing system in Jessore aimed to develop an

improved understanding of its strengths and weaknesses, the overall impact on the sector and the livelihood profile of its stakeholders.

3.4.3.1 Farmers' marketing

Markets and marketing is critical for agricultural technology adoption. Factors such as location, supply, demand, marketing systems which affects both production systems and livelihoods are important (Duygan, 2005). The study found that existing prawn marketing systems met most of the primary requirements of prawn farmers in Jessore. The study found several factors that satisfied farmers' needs. Firstly, farmers' had different options to sell their prawns at the farm gate and/or *depos* (local *depos*, commission *depos* and *foira*. Most farmers could use several options. This practice was also observed in selling other agricultural products like poultry (chicken and eggs), vegetables, etc. (Islam, 2003). Like prawn, *foiras* can buy these products at the farm gate or farmers can sell local markets and town markets. However, *gher* farmers could sell any quantities of different sizes (grades) prawn at any time of the year. This was mainly because of the increasing international demand for prawn and that many processing factories were running 50% of their capacity due to over capacity of factories compared to supply of raw product (Khatun, 2004; IUCN, 2004; Davis, 2006). The options for farmers to sell prawns in very small quantities, as little as 1 kg of prawn, was found to be critical for worse-off farmers who required regular cash flow for maintaining daily life and farm inputs in low income months (rainy season). Therefore, although prawns are fully export oriented commercial product, it provided a short term coping mechanism for worse-off farmers during vulnerable months.

Farmers had good access to markets both in terms distance and transport as the majority of local *depos* and many commission *depos* were situated along the *paka* (bituminous) roads through the prawn farming villages, which reduced marketing costs and risks. Moreover, most of the *depo* staff were local people, which created a friendly relation and easy access to the *depos*. The instant and easy access to market

the products probably had important influence on small-scale farmers to adopt prawn farming (Little and Bunting, 2005; Dercon and Hoddinott, 2005). Karim (2006) found that better access to markets enhanced the commercial orientation of peri-urban aquaculture compared to that of rural villages that had poorer communications.

Services provided to farmers affected farmers' adoption of agricultural technology. The post-harvest services provided by the *depos* to the farmers had been found to increase over the years and positively lead to adopting of *gher* farming. Increased competition among the *depos* appeared to have led improved services to farmers such as providing harvesting net, prawn carrying containers, on-farm selling facilities etc. Moazzem (2004) noted a similar observation while studying potato marketing. The increase in the number of cold storages facilities led the owners to intensifying their services such as providing information on demand and the price of potato, proper documents of storage status, and interest free credit to clients, and to introduce the provision of discount on storage charges (Moazzem and Fujita, 2004). Increased number of *depos* also provided the farmers with the opportunity to compare prices between different *depos* leading to more competitive prices from the *depos*. These services provided to farmers by the *depo* owners probably enhanced expansion of *gher* farming.

Alongside the above positive aspects of prawn marketing from the farmer's point of view, the farmers were more ignorant of prices paid by processing factories (to *depos*) and global commodity prices. Farmers and the local *depo* owners were more likely to know when the international price fell than when prices increased. This was probably a result, derived from the control of prawn prices and other information by the processing factories (exporter). Making timely and unbiased information available to the farmers help them, in bargaining with the middleman for a fair price for their crops (Islam et al. 2006). The study found no mechanism to access such information on demand and price by the farmers. Distress prawn selling of prawns has been related to a lack of access to marketing information (Khatun, 2004). Marketing

information helps farmers to make decisions in the short term what price to expect, and decide what and how much to produce. The improved information system gives farmers accurate knowledge of price movements and enables them to identify trading opportunities in markets during short in supply (FAO, 2007). Access to marketing information for prawn farmers is not only important to achieve fair price of products, but also essential to refine products to meet quality requirements and market expectations (Davis, 2006). Information on international demand and market price will help farmers understand the future prospect and problems of market commodities (Islam, 2006). This information is crucial for poor farmers to decide their future investment in the context of rapidly spreading *gher* farming in Jessore.

3.4.4 Freshwater prawn marketing chain and processes

The export marketing channels for prawn are different from other fisheries products such as freshwater and marine fish marketing and are operated separated from the domestic fish marketing (FAO, 2001a; Kleih et al. 2003; Dorward et al. 2004). Prawn and shrimp marketing in Bangladesh is characterised by various level of intermediaries. Almost all the prawn produced in Jessore including the sample study area are channelled to the processing factories in Khulna and processed for export. The prawn produced in Jessore was found to pass 2-3 levels of intermediaries between farmer and processing factories. The chain was found similar to the shrimp marketing chain in Bagherhat and Shatkhira described by Khatun (2004).

3.4.4.1 Infrastructure and facilities:

The infrastructure of the prawn industry has been mostly developed by the private sectors. The government developed the road communications and established quality control offices and laboratories. The private sector infrastructure include *depos*, commission agents, processing factories and ice factories and other facilities like water transport, supply, ice etc.

Road communication and transportation have direct and significant influence on the adoption of the agricultural production system in relation to the marketing of products (Bakht, 2000; Karim, 2006). Better road communication increases market access for farmers. Research shows that being one hour closer to a road, which improved access to a market, provides the opportunity to remarkable increase in farmer's productivity (IFPRI, 1998). Development of Jamuna bridge, for example, which links northern region to the south and the capital city, had significant positive impacts on crop diversification and integration of markets throughout the country (New Age, 2005; Sen and Hulme, 2005). A recently conducted impact study concludes that the Jamuna Bridge has substantially reduced poverty and increased economic and social opportunities across the nation in general and in the northwest region in particular (ADB, 2003).

Improvement of rural roads leading to better access to markets was found to influence the adoption of *gher* farming in remote areas. The *gher* farmers and the marketing intermediaries studied confirmed that road communication developed by the government over past five years was significant. Many roads had been extended and improved from earthen to concrete structures and extended to the village level. However, the poor condition of roads due to inadequate maintenance made the prawn transportation unsmooth and time consuming (Bakht, 2000). Quality of road communication and transportation have direct implications on the quality and value, of perishable products. To overcome similar problems a number of fish processors and exporters in Kenya and Ethiopia provided ice and transport facilities to their suppliers to maintain hygienic quality of products (Henson et al. 2000).

On the other hand, a major infra-structural renovation was carried out in almost all stages of post-harvest functions to comply with the quality requirements after the EU ban (Cato and Santos, 2000). The *depo* owners, those who established *depos* before the ban, informed that they also upgraded their *depos* by constructing cement floor, replacing the wooden grading platform to still platform etc. While the newly built

depos were built to include those facilities required to comply with the new standard. However, these renovations required significant investment both from the government and private owners (Athukorala and Jayasuriya, 2003). A recent study (IUCN, 2004), found that the estimated total cost to upgrade the existing facilities would be US\$ 17.6 million. The frozen food exporters of Bangladesh spends about US\$ 2.2 million per year and the government spends on average US\$ 225 thousands to maintain a monitoring programme that and to complies with the rules and regulations under HACCP. Although the large factories were able to cope with the situation, more than 50 small factories permanently were closed in Bangladesh since the ban in 1997 (Panorama Acuicola, 2005). However, investors in prawn marketing like *depo* owners were concerned about future frequent changes of quality standards with the advancement in scientific knowledge about health hazards and improvements in food processing technology.

3.4.4.2 Prawn handling

Food quality assurance is now recognized as essential for an efficient and internationally competitive business. International markets demand that all steps in the food supply chain take customer and consumer preferences fully into account, that suppliers meet tighter food hygiene and safety standards, and assure constant quality (Loc, 2006). Therefore, prawn quality control is an increasingly important issue in the prawn sector both nationally and internationally (Rahman, 2001). Recognizing both the potential for Bangladesh's exports and the problems with safety and quality of the product, FAO assisted Bangladesh to improve product standards with developed regulations and inspection schemes in the early 1990s based on the HACCP approach (Cato and Subasinghe, 2003). Despite these efforts and major investments in upgrading factory infrastructures, Bangladeshi shrimp exporters continued to suffer from real problems of negative reputation in quality (Bayes et al. 2005).

Although the study did not examine the health and hygiene aspects of prawn quality microbiologically, a number of issues at pre-processing (before processing in factories) stages were identified from observations that can be attributed to poor quality control. Firstly, it takes a comparatively long time (22 hours) after harvest to complete the chain and all formalities to reach the processing factories, though the distance between study area and processing factories in Khulna is within 100 km. Three main factors contribute to this; i) buying (grading and weighing) local *depos* during the day and preparing for selling at night, ii) re-organising of prawn (re-grading and weighing) at commission *depos* and commission agents, and iii) time consumed for transport due to poor condition of local roads. The long time used at the pre-processing stage may affect the quality of prawn products. Toufique (1998) identified unhygienic means of shrimp transportation and preservation as one the factors affecting shrimp quality in Bangladesh.

While, the prawns are kept iced throughout, information on the effect of such handling and transporting at each stage on ultimate product quality in Bangladesh is unavailable, the importance of proper handling and transportation of perishable products like prawn and shrimp is well established (Cato and Subasinghe, 2003; Jittinandana et al. 2005; Loc, 2006). As the demand for internationally traded foods products in general and perishable products in particular depend upon the end quality of products. This information is important for upgrading practices in the future. In addition, consumers' behaviour regarding food quality is changing with the increased knowledge of health and hygiene (Zeithaml, 1988; Grunert, 2002; Jarvela et al. 2006). Therefore, quality control that includes handling, transportation, storage and processing are important determinants of demand of products. While studying the tuna fishery in Hawaii McConnell and Strand (2000) found harvesting and handling methods for tuna were an important price determinant and they found tuna price increased about 7% when caught by lining and properly handled. However, the quality of fisheries products can be affected at any stage by post-harvest functions.

Contamination of fisheries products with harmful pathogens is a concern of quality control. The presence of human pathogenic bacteria in fish and fish products may also be attributed to contamination during pre-processing handling and processing (Håstein et al. 2006). The study found that the industry lacked appropriate transportation, like insulated vehicles and prawns were transported in truck with simple plastic covers, which was likely to affect product quality inconsistent.

Transport is also an important factor that affects the quality of perishable products. Physical disturbances during the transport of aquatic products are unavoidable in marketing and processing that affect flesh quality (Thomas et al. 1999). Food temperature is a critical determinant of quality and shelf life of aquatic animal food products. In general, aquatic products should be kept $<5^{\circ}$ C temperature for food safety and longer self life. Ice is commonly used to maintain quality for fish and other aquatic animal food products as by icing food temperature can be maintained slightly above 0° C (Pineiro et al. 2004). The supply of only one ice factory in the study area was found to inadequate to all the *depos* for storing and transporting prawns. In addition, frequent power failure made the situation even worst (Khatun, 2004).

Awareness, knowledge and skill gaps in quality control are some of the major barriers to implementing HACCP system in practice. The owners and operators, particularly in developing countries may be committed to ensuring food safety; but lack of technical knowledge and competence about food safety and HACCP limit any setting of effective prerequisite quality control (FSAI , 2001; FAO, 2003). Even with several years of government promotion of HACCP, a significant number of quality measures were ignorant of the concept (FSAI, 2001). However, in general, the focus of prawn quality control in Bangladesh encompasses processing factories. The above issues at pre-processing (farm gate to factory gate) should be addressed to establish the HACCP system fully in practice. In addition the study found that the majority of the people (70%) employed at local and commission *depos* were from different backgrounds, which refers that they had little or no orientation or training for best

practice in post harvest activities. Therefore, the people involved in post-harvest handling and processing needed to be trained with prawn quality control measures.

Pricing of product or services is one the most critical and complex aspects of marketing (Indounas, 2006). There is no government pricing policy found for prawns, rather it is driven by international demand and supply. The case study shows that the international buyers place their order and price of prawns for individual grades to the buying houses, which mostly determined the local price of prawn. According to order and price suggests by international buyers, the processing factories decide the price and announced to commission agents and thus to other levels of intermediaries.

The price of prawns, however, differs with the grades. The study found that slightly different prawn grades were used for farmers than other transactions like local *depos* selling to commission *depos*. This created barriers for farmers obtaining fair prices for their prawns. Therefore, grading and pricing need to be standardized as well as information on international demand and price needed to be available at all level of stakeholders, particularly farmers if fair trade is to be ensured.

While introduction and rapid expansion of prawn farming brought significant benefit and welfare for rural livelihoods and prawn sector as a whole, concerns as well as challenges remain for sustaining the benefits and investment made in the sector, particularly for small-scale poor producers. As 92% of prawn and shrimp produce in Bangladesh is exported, the sustainability and growth of the sector almost certainly depends on volume of international trade, which is likely to affect by international demand and supply, consumers preference, tariff and non-tariff barriers (FAO, 1998a; Williams et al. Undated). From the current trend it is projected that the global demand for seafood products continues to increase in short and medium-long term due to increase of world population, increase in income and rapid urbanization, particularly in developing countries (FAO, 2006b)

However, prawns produced in Bangladesh were mostly exported to United States and European countries (DoF 2005). Therefore, the future export of prawns is largely determined by the demand of these countries and finding new markets. While the global demand for prawn products continue to increase, prawn is competing with shrimp, mainly black tiger shrimp (*Penaeus monodon*) for markets. In addition, the huge increase in production of the American white prawn, *Penaeus vannamei*, have led to price of smaller shrimp being driven down (Hambrey, 2006). The substantial increase in the quantity of shrimp traded coincided with the strong expansion in aquaculture shrimp production, which has grown rapidly since 1997, with an increase of 165 percent during the period 1997–2004 (annual growth of 15 percent). Therefore, the unit value for shrimp exports increased in the 1990s to reach US\$ 6.9/kg in 1995 and since then it has declined to US\$ 4.5/kg in 2004, probably as a result of the strong rise in production (FAO, 2006a).

In a recent study in European countries, Hambrey (2006) found that at the present time demand specifically for prawn is limited and specialised, and mainly associated with expatriate South Asian communities living in Europe. As a result, a slight decline in the price of Bangladesh sourced prawn was observed against increase of global production, although prawn from Bangladesh still receive a premium price compared to other countries (FAO, 2006a). Given the slight decline in value of Bangladesh sourced it would appear that market demand is not expanding as rapidly as production (Hambry, 2006). Therefore, policy and support for future promotion of the sector, which expected to include and invest poor stakeholders in production, marketing and other support services, should be reviewed carefully.

3.4.4.3 Non-farm rural employment in prawn marketing and impacts on livelihoods

Generating productive employment for the ever-increasing working age population in rural Bangladesh is a formidable challenge. During the last two decades the country

witnessed a gradual transformation from a rice based economy to diversified rural economy (Toufique and Turton, 2003; FAO, 2004b; Hossain, 2004b). Diversification has occurred both within agriculture and non-farm activities. The importance of rural non-farm (RNF) activities in generating employment and incomes during the process of economic development is widely recognized. In Bangladesh, RNF accounted for over 40 percent of rural employment in 2001. Thus the non-farm employment is recognised as critical for rural livelihoods and is increasingly gaining emphasis for rural development (Awal and Alam, 2004). The study revealed that prawn farming had played an important role in the non-farm rural economy and generating employment for rural people. On average there were eight people working at *depos*. Moreover, the gradual increase in the number of people working in prawn marketing, found in the study, clearly indicated that there was new employment generated in prawn marketing with the growth of the sector. Increase in the number of *depos* around the study farming communities during the last 10 years further enhanced the non-farm employment generation. In a study of 57 districts in Bangladesh (Hossain, 2004b) observed that the non-farm rural employment as a primary occupation of rural households grew from 34% in 1987 to 53% in 2000. The non-farm rural diversification includes a range of services, business, vending, transport labour, rickshaw/van puller, mechanics, tailoring, non-farm labour etc (Toufique and Turton 2002; Hossain 2004b).

Declining access to cultivable land and increasing of land poverty are the most important driving forces for the rural poor to be increasingly engaging in non-farm activities (Saha, 2002b). The Bangladesh Institute of Development Studies (BIDS) study in 1987 and 1991 shows that land-poor are increasingly engaging in non-agricultural activities Hossain (2004b). This shift not only increases their income and employment security but also reduces their vulnerability by reducing fluctuations in income flows over the whole year.

The significance of the employment generated in prawn marketing was that the poor had full access to the opportunities. The labourers (seasonal and permanent) comprised the major proportion (61%) of the marketing employment at *depo* level. The seasonal labourers were found to work mainly as helpers in restaurants and *Kuli* (transport labourer) in the off-season. Such switching of income activities is a common phenomenon of the rural poor (Sen, 2003; Ravallion and Wodon, 2000). More than two thirds of the people working in the marketing chain were from different professional backgrounds, which established that the employment generated in prawn marketing was not restricted to certain professional groups, but rather wide open and included previously non-associated people. Many of them used their previous experience and skills to be involved in the marketing chain, such as vegetable and fruit retailers became prawn and fish seed traders, some small shopkeepers established local *depos* adjacent to the village.

The remaining one third of the people who changed their position or firm within the marketing chain mostly accessed better positions or higher pay, which indicated that experience gained in prawn marketing was valued through promotion, but more importantly there was freedom to choose firm and scope for changing firms.

“More income” than previous jobs was the most important factor that influenced the stakeholders to take up the job in prawn marketing. However, there were a wide range of other interests that indicated that employment in prawn marketing met other needs for different levels of stakeholders. This also implies that the welfare of employment is an important motivation for rural people as well as represents a feature of dynamism of the rural livelihoods in Bangladesh in general (Afsar, 2003). “Finding a job closer to home” was found one of the reasons to be involved in prawn marketing for many employees, mostly labourers, who used to migrate or travelled daily far away from their villages to usually urban areas for work. Jobs close to home allowed them to be involved in other income generating activities like agriculture, small businesses etc and improved social stability and investment in children’s care etc.

The majority of business owners found new opportunities in prawn marketing, many of the *depo* and set owners started marketing as an employee and later established their own business. Davis (2003) notes that the response of individuals to new opportunities and diversification of livelihoods has two attributes; “demand pull” and “distress push”. “Demand pull” diversification is a response to new market and technological opportunities, while distress push is driven because there are no opportunities. The distress push is likely to happen in remote areas with less favourable conditions (FAO, 2004b). Frequent draught or successive flood in Bangladesh that depressed income and hence increase need for alternatives. On the other hand, when favourable conditions are developed, for example remote areas are linked with urban markets by road and other infrastructures are built, new market and employment opportunities are generated “pull” factor becomes driver (Davis 2003). The later factor can be related with “finding job closer to home” as a reason for being involved in prawn marketing in Jessore. However, the main motivation was that the employment with marketing provided them with the opportunity to live with their families as well as spare time to be involved in other income generating and household activities.

The employment in prawn marketing needs to be related to the wider rural livelihood transformation in the country. Bangladesh has witnessed spectacular growth in the rural non-agricultural sector during a time when the agricultural sector grew slowly, which occurred through migration, urbanisation, infrastructural growth, and the impact of trade liberalization (Hossain, 2004b). These developments and processes are creating new ways of earning a living. The greatest expansion has been observed in the service sector. The number of small shops in villages has increased substantially, as have tailoring and other craft enterprises, rickshaw pulling and petty trading in villages and local bazaars (Toufique and Turton, 2003). Although such diversification is an emerging feature of the country, the employment in prawn

production and marketing directly and indirectly boosted the dynamism in diversification of rural non-farm livelihoods.

3.4.4.4 Livelihood impact on marketing stakeholders

The quality of employment generated in prawn marketing is an important aspect. The qualitative assessment suggested that the impact of employment in prawn marketing has significantly improved household livelihoods. The majority of the stakeholders (82%) at *depos* and *set* level confirmed that their livelihood outcomes improved over the previous five years. The lack of major differences in livelihood improvement between employees and business owners indicates that the equality of benefits from the employment.

The investigation of livelihood impacts highlighted three aspects of livelihood outcomes. Firstly, of several livelihood outcomes including the basic needs; food, clothing, shelter, education and health, simultaneously improved over the last five years through employment in marketing. Considerable difference in livelihood outcomes for employees and business owners found in the study were mainly due to differences in needs of the two groups. The major difference between the two groups was found in improvement of food and clothing. The effect of increased income on food and clothing was higher for the employees. Hossain (2004a) found that rural households spent about 52 percent of their income on food items and a 10 percent increase in income would lead to a 6.5 percent increase in the demand for food items. He also suggested the income elasticity of demand for food was higher for the poor. Choi (2004) found that the non-farm income is significant (44%) to total income in rural areas in south Asia, which significantly impacts on purchasing power and, hence the food security. The income from non-farm employment was also found to be significant in coping seasonal food vulnerability for rural poor of developing countries (Reardon, 1998).

Secondly, the study that revealed about half of the stakeholders was able to improve their asset base over the last five years. Improving the asset base of the poor is crucial. Rural poor farm households often lack the assets that serve as important capacity variables for participating in income generating activities. Without improving the asset base of the poor remain vulnerable (Choi, 2004). The business owners were able to improve their asset bases through mainly buying or leasing land and *gher*, establishing *depo* or *set* for business and the employees purchased land (homestead and cultivable land), livestock, small shops (operated by other household members), purchase or rented of vans. Improvement of these physical assets was crucial for the poorer employees to diversify income and thus reduce chronic vulnerability. Income from those physical assets was found to be an important means to secure and enhance non-farm employment as remunerative non-farm activities, like fry trading, often require investment. Reardon et al. (2001) notes that the reliance on non-farm income diversification is widespread in rural Africa, but not all households enjoy equal access to attractive non-farm opportunities. He found a positive co-relation between landholdings and non-farm diversification and income. Similarly in Rwanda, where farm incomes and landholdings are unequally distributed, those with the least agricultural assets and income are typically also least able to make up this deficiency through non-farm earnings because they cannot meet the investment requirements for entry into remunerative non-farm activities (Barrett et al. 2000; Reardon et al. 2000).

The other important assets improved for the stakeholders was social honour and networks. About one fifth of the prawn marketing stakeholders mentioned that their social network was enhanced. This occurred with increased income and through increasing social exchange through hospitality and exchange gifts among neighbours, friends and relatives. Social networks and contacts are used by individuals and households to enhance their asset base and access to income-earning opportunities like market information, buyers, wage employment, loan, inputs on credits, share resources etc.(Davis, 2003). Using data from Sub-Saharan Africa (Fafchamps and

Minten, 1998) shows that social capital has a positive effect on traders' sales and gross margins. Group enterprises like, "producers' group" in Uganda was found to increase access to non-farm activities and to returns associated with the activities (Cannon and Smith, 2002).

Thus the welfare linked to employment in prawn marketing for the stakeholders has established through the study, but sustainability remains a question. While the income from the employment improved some of the asset base for marketing stakeholders, Davis (2003) mentions education and skill, financial capital and physical infrastructure are also important determinants of non-farm rural employment. Improving these assets would be crucial for sustaining the employment of stakeholders over longer term.

CHAPTER 4 Exploration of the impacts of pond aquaculture in Mymensingh district

4.1 Introduction

The prime aim of conventional aquaculture has been to support household fish consumption in Bangladesh. Therefore aquaculture, particularly small-scale aquaculture, was predominantly a household based activity (ADB, 2005). Conventional systems are mostly extensive or semi-intensive, which involve low levels of input and management. Fish is grown mainly on natural foods, which are enhanced by applying organic and inorganic fertilizers and farmers irregularly supply rice bran as a supplementary feed (DoF, 2002). Though the contribution of such extensive aquaculture is significant to households, particularly in terms of fish consumption, the actual yield has been low (Muir, 2005). However, a brief of conventional aquaculture has been outlined at 1.1.3.1 in Chapter 1. An increasing trend in the demand and price of fish with the growth of population and rapid urbanization has influenced many farmers to shift to commercial fish production by intensifying the systems (Dey, 2000). Fish prices have been increased at 2.8% per year over the last 15 years due to insufficient supplies of fish compare to increasing demand (Islam et al. 2004b).

Commercial status of small-scale farms aims to increase cash output by increasing yield through intensification of the production systems (Karim, 2006). Although, such commercialization of aquaculture by private operators including small-scale farmers has increased in some areas across the country over the years, intensification has emerged particularly in the Dhaka-Mymensingh region (ADB, 2005). Intensification has occurred both vertically, by increasing production per unit area through using improved (some cases commercial) feed for fish, multiple stocking and harvesting, increasing labour inputs etc., and horizontally by converting many low-lying rice fields into shallow ponds.

Such advancement of aquaculture in Mymensingh is likely to benefit farming households (Brown, 1998). However, growth of agriculture impacts wider rural economies directly or indirectly. The benefits spread beyond farming households to wider livelihoods and an impact study is not complete until these effects are evaluated (von Braun, 2005). The impacts of recent aquaculture development in broader rural livelihoods in Mymensingh remains largely unknown. Improved understanding of such impacts would enhance the contribution of aquaculture to rural development in general and poverty reduction in particular.

While adoption of agriculture technology is largely determined by demand of product and efficient marketing (Weinberger and Lumkin, 2005), growth of agriculture is likely to boost marketing transactions and new opportunities. Marketing as an important institution can facilitate or inhibit to gain such livelihood opportunities (DFID, 2006). Therefore, access to market is critical for farmers, particularly the poor who possess only limited human capital. While aquaculture in Mymensingh is growing rapidly, Sarker et al. (2006) notes lack of marketing facilities are a medium level barrier for aquaculture entrepreneurship development. In this context, knowledge of the drivers of fish marketing, dynamics of the system and actors as well as impact on aquaculture and broader rural livelihoods would assist pro-poor policy development leading to the country's poverty reduction strategy.

This chapter aims to explore the broader impacts of aquaculture, particularly the adoption of the commercial operation of small-scale farms on rural livelihoods and tests the broader hypothesis that pond aquaculture production and marketing have enhanced rural livelihoods in Mymensingh.

4.2 Methodology

This section of the chapter briefly describes the research process of village selection for the Mymensingh site and the sample size of the tools used to collect data on the impact of pond aquaculture and marketing of fish in Mymensingh in order to achieve

the aim of the research and to test the working hypotheses described in 1.4.1.in Chapter 1. The detailed processes and purposes of the tools used for this section of the research have been described in Chapter 2.

4.2.1 Selection of sample villages:

Sample villages were purposively selected from research collaborator POND LIVE Project’s study villages. The POND LIVE Project had been working in six study villages in six different thanas in Mymensingh district by the time the current research was initiated. Required secondary information was collected from the POND LIVE project staff. The project divided six villages in two groups with 3 villages in each group as i) peri-urban and ii) rural (Table 4.1). The current study randomly sampled two villages from each group, totalling four villages in Mymensingh. The names of the villages were for group i) Damgaon and Ayenakhet, as peri-urban locations and ii) Goatola and Koirahati for the rural. The procedure followed for selecting sample fish farming household is outlined at 2.3.15 in Chapter 2. A map of Mymensingh indicate the locations of the study villages is shown (Figure 4.1).

Table 4.1: Criteria of rural and peri-urban villages

Variables/indicators	Locations	
	Rural	Peri-urban
Communication	Poor communication with other thana and district	Better communications compared to rural area
Marketing	Less developed marketing channel	Well established marketing channel
Technology adoption	Low adoption of improved agricultural technology	High adoption of improved agricultural practices

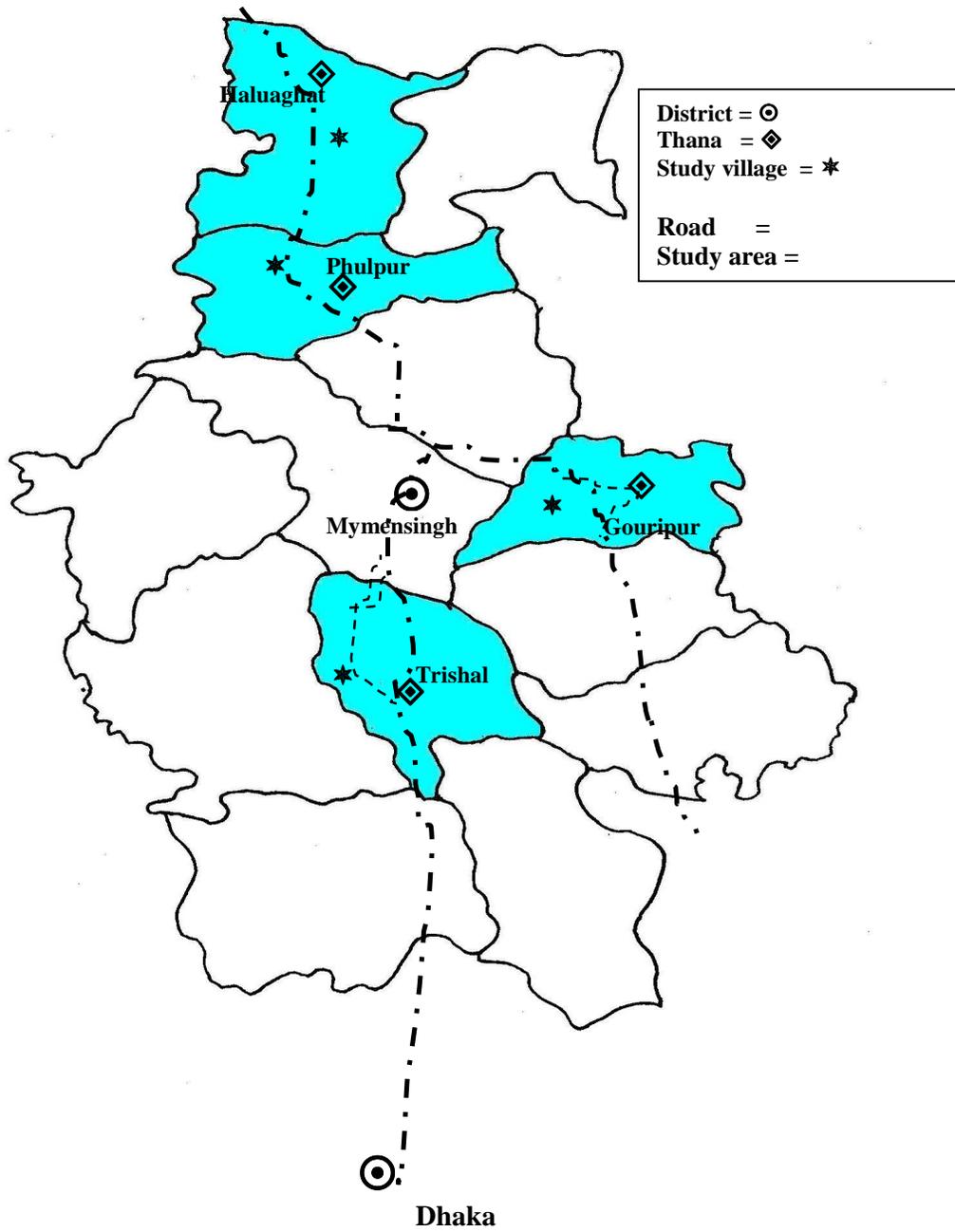


Figure 4.1: Map of Mymensingh district showing study villages

4.2.2 Sample size for method and tools used

The number of samples for interviews and focus group discussion (FGDs) is outlined below in Table 4.2.

Table 4.2: Number of samples/participants in different data collection tools

Survey tools	Number of samples/participants
Interview of pond fish farmers (Baseline and monitoring)	42 (Total)
FGDs with fish farmers (in each village)	72 (Total)
FGDs with pond labourers	64 (Total)
FGDs with fishers (harvesting team)	61 (total)
Tracking marketing chain (from farm to consumers)	2 times from 2 villages
Marketing margins (follow of retailers)	45
Observation of marketing activities	4 auction markets and 5 retail markets
Individual interview with marketing intermediaries (semi-structure questionnaire)	157 people (from above 4 auction and retail markets)
Individual interview with women from fish farming households	144 women from 4 sample villages

The questionnaires used for interviews were validated before data collection through a process described at 2.3.15 in Chapter 2. The procedure followed for data processing and analysing have also described in Chapter 2.

4.3 Results

This section of the chapter contains the results obtained by analysing the data collected through the research process and methods described in sections 4.2 and Chapter 2. Results are presented under three main sub-sections (4.3.1 – 4.3.3).

4.3.1 Livelihoods impacts of aquaculture al production level

The livelihood assets profile of pond fish farmers in Mymensingh were obtained through questionnaire survey is shown in two farmer categories in

Table 4.3. The main difference between better-off and worse-off farmers was in natural and human capital base. The pond size and arable land of better-off farmers was significantly higher ($p < 0.05$) than that of worse-off farmers.

Table 4.3: Summary of livelihood assets of pond fish farmers by well-being

Assets	Worse-off	Better-off
	Mean \pm Stdev (% farmers)	Mean \pm Stdev. (% farmers)
Family size	5.63 \pm 2.36	5.89 \pm 2.22
Household head (5-12 class) %	35%	55%
Pond size (ha)	0.097 \pm 0.091	0.190 \pm 0.19
Arable land (ha)	0.505 \pm 0.12	1.319 \pm 1.06
Cattle (number)	3.0 \pm 1.6 (56%)	4.0 \pm 2.88 (76%)
Goat (number)	1.74 \pm 1.90 (53%)	2.20 \pm 2.10 (60%)
Poultry (Chicken & duck) number	20 \pm 14.40 (100%)	18 \pm 9.64 (98%)

4.3.1.1 Aquaculture practices in sample villages in Mymensingh

Aquaculture practices in the sample villages were found to be semi-intensive. However, some farms were more intensively and commercially operated than others. The majority (85%) of the farmers in the village Damgoan and Ayenakhhet operated their farms commercially and adopted a multiple stocking and harvesting strategy. While in the other two villages (Goatola and Koirahati), the proportion of commercially operated farms was 45%. Usually the new season of pond fish production started in May by stocking ponds with new season fingerlings, while the

more commercial farmers with perennial pond stock in February with the previous year fingerlings. All farmers practiced polyculture and stocked a range of Indian and Chinese major carp species. Stocking density averaged 29247/ha (± 15692). However, this varied among individual farmers with respect to size, species and capability to invest in aquaculture. Farmers harvested fish for home consumption as required. Commercial farmers aimed to grow medium size carp (about 0.75-1.5 kg) for sale. A general timetable for farmers using multiple stocking and harvesting is given in Figure 4.2.

Word key: S= Stocking with current year fingerling, S*= Stocking with last year fingerling and S** = Stocking small fingerling for next year grow-out PH= Partial harvesting and FH= Final harvesting												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Stocking (S)		S*									S**	
Harvesting (H)					H	H			H		FH	FH

Figure 4.2: Fish fingerling stocking and fish harvesting strategy for more commercial farmers

4.3.1.2 Livelihood impact on fish farmers

The overall mean fish production in sample villages was 2908 kg/ha/year (± 813). There was no remarkable difference between better-off and worse-off farmers' yield (Table 4.4). The mean household production of better-off farmers was significantly higher than worse-off farmers due to bigger pond size. The mean total annual income for household was collected through monthly monitoring did not differ significantly ($p > 0.05$) among the villages. However, the mean annual income significantly differed between worse-off and better-off farmers in all villages.

Table 4.4: Mean fish production and annual income of fish farmers

	Worse-off	Better-off
Mean fish yield (kg/ha)	3227 (± 878)	3416 (± 956)
Household fish production (kg/ha)	255 (± 133)	464 (± 172)
Mean total household income (Taka)	53421 (± 15880)	105994 (± 33295)

The overall mean annual household income was Taka 79708. The contribution of fish to total household income was 21% (Figure 4.3). However, the proportion of income from fish sale to the total household income did not differ between better-off and worse-off farmers, although absolute incomes differed in fish sale.

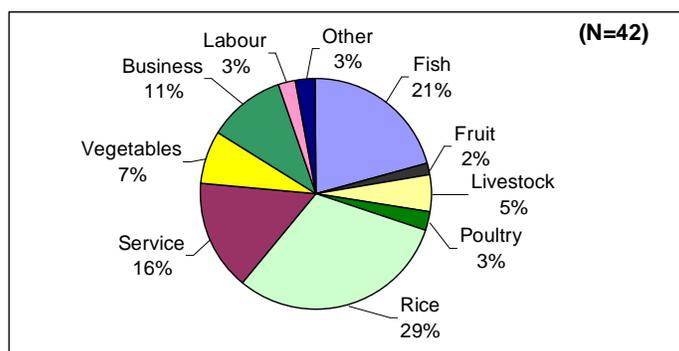


Figure 4.3: Contribution of individual income sources to total household income

4.3.1.3 Household food consumption of fish farmers

Monthly monitoring of food consumption showed that the major proportion of fish and vegetables consumed by the farming households was sourced from farm (Figure 4.4). The annual per capita fish consumption of fish farmers was 13.6 kg and did not differ significantly between worse-off and better-off farmers.

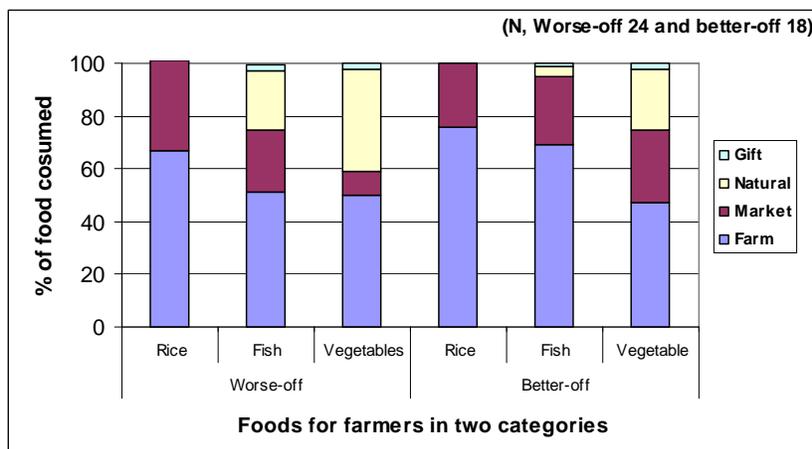


Figure 4.4: Source of rice, fish and vegetables consumed by farming households

4.3.1.4 Livelihood impacts on aquaculture labourers

The agricultural labourers that were involved in aquaculture as wage labourers are referred as aquaculture labourers. However, the majority of the labourers were part-time in aquaculture and they also worked on other agricultural activities like field crop, livestock, vegetable fields, etc as convenient. The results of FGDs with labourers involved in aquaculture are shown in Table 4.5 and described below;

Table 4.5: Status of pond aquaculture labourers in Mymensingh

Events	Name of sample villages			
	Damgaon	Ayenakhet	Goatola	Koirahati
Number of aquaculture labourer (full and part-time)	60	45	90	40
Proportion (%) of aquaculture labourers compared to agricultural labourers	66%	64%	30%	53%
Mean daily wage 10 years ago (Taka)*	65	65	62	60
Mean daily wage at present (Taka)	95	95	90	90
Lean period for labourers in a year 10 years ago (month)	4	4	4	4
Lean period for labourers in a year at present (month)	2	1	3	2

* Amount (Tk) is adjusted with inflation rates

Aquaculture labourers recognized that aquaculture had become intensified by the farmers, even small-scale farmers over the last 10 years. The mean proportion of aquaculture labourers in Damgaon and Ayenakhet averaged 65%, where the majority of farmers had intensified their production systems was higher than Goatola and Koirahati which averaged 42%. The mean days worked on aquaculture activities for labourers increased from two to five days per week in the sample villages over the 10 years in Mymensingh (Figure 4.5). However, opportunities for labourers in Damgaon and Ayenakhet averaged 5 days/week and was higher than in Goatola and Koirahati, which averaged 2.5 days/week. The mean inflation adjusted the labour wage (all villages) increased from Taka 63 (USD 1.0) to Taka 93 (UDS 1.5) over the last 10 years (Table 4.5). There was not much difference between villages regarding wage rates. In Mymensingh labourers were only paid cash; no meal was included in the contract.

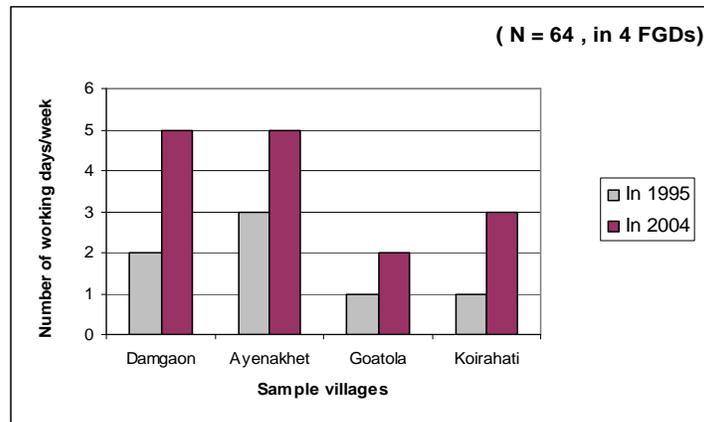


Figure 4.5: Number of working days in 1994 and 2004 for villages

While netting ponds fish farmers often gave a small quantity of fish (200-300g) to each labourer as an incentive. On average labourers received such bonuses roughly once a week (ranged 0.5 – 2.0 days/week), which comprised 25% of the fish (by weight) consumed by labourers' households (Figure 4.6).

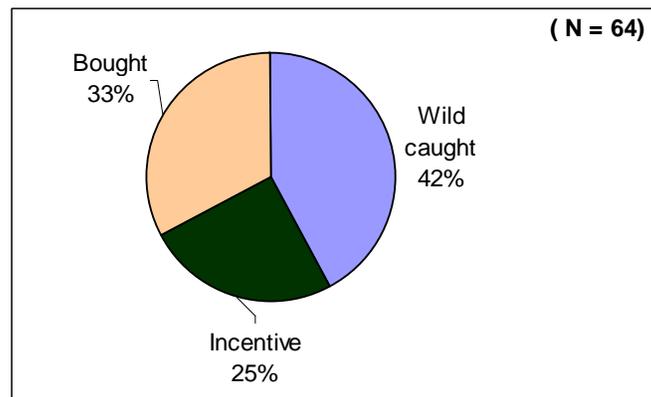


Figure 4.6: Source of fish (by weight) consumed by aquaculture labourers households

The rest of the fish consumed by the labourers' households was sourced from open waters (42%) or bought (33%) from the market. In the FGDs, it was established that on average household food consumption had improved for 90 % labourers over the last 10 years, while clothing and housing had also improved for 75% and 70% labourers respectively over the same period.

4.3.1.5 Livelihood impact on fishers (fish harvesting team)

Results from the FGDs conducted with the fishers harvesting fish from ponds in sample villages are presented in (Table 4.6). The number of fishers, who are involved in harvesting fish from ponds in sample villages, averaged 37 (\pm 6.7). Daily wages also increased significantly from Tk 70 (USD 1.12) to Tk. 110 (USD 1.77) over the last 10 years (Table 4.6). The real daily wage did not differ between villages. Focus group discussion with fishers established that average household food consumption increased for 90% of the fishers, while clothing, health care and housing had been improved for 85%, 60% and 65% of fishers respectively (Table 4.6). The Majority of fishers (86%), whom used to catch wild fish from open waters on an average a 5.8 days per week and harvest of fish from ponds was only occasional in the past.

Table 4.6: Livelihood impacts of aquaculture on fishers in Mymensingh

Events	Damgaon	Ayenakhet	Goatola	Koirahati
Number of fishers work in sample village	46	35	30	38
Daily earning 10 years ago (Taka)*	75	75	60	70
Daily earning at present (Taka)	115	105	95	125
Food improved (% of labourers)	95	90	90	90
Clothing improved (% of labourers)	85	90	80	85
Housing improved (% of labourers)	70	65	65	65
Health care improved (% of labourers)	60	60	60	65

Social change:

- ▶ Interaction with farmers and other stakeholders increased
- ▶ Can borrow money from farmers
- ▶ Social mobility increased

* Amount (Tk) is weighted by inflation rates

However, harvesting fish in ponds had increased remarkably over the last 10 years to become the major activity averaging 4.4 (\pm 1.2) days/week from 1.7 (\pm 0.33) days/week for sample villages. The mean fish harvesting days per week in ponds was higher in Damgaon and Ayenakhet averaging 5.2 days/week compared to 3.5 days/week in Goatola and Koirahati (Figure 4.7).

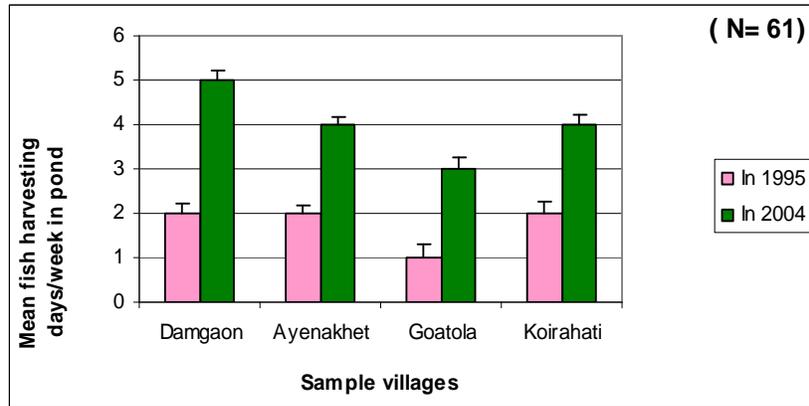


Figure 4.7: Number of fish harvesting days (per week) in ponds for fishers in sample villages

Figure 4.8 shows that fishers diversified their livelihoods and 35% (± 3.0) of the total fishers, who used to harvest fish in the sample villages, were involved in part-time retailing of fish in rural markets. Additionally 18% of them worked as part time labourers for pond management activities. During the last 10 years 8% of fishers had stopped being fishers.

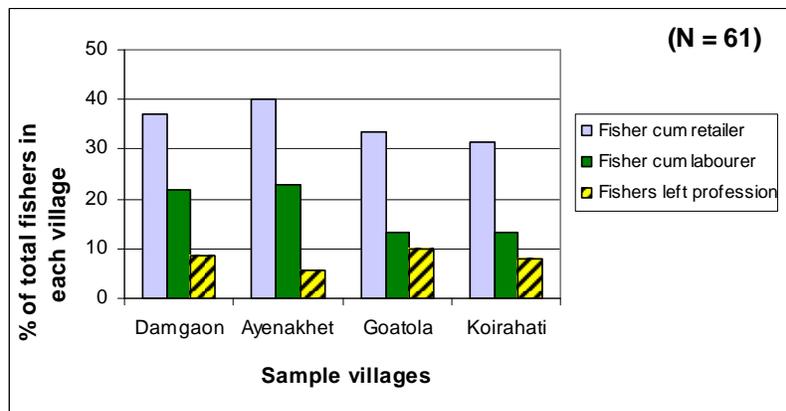


Figure 4.8: Percent of fishers involved in part-time retailing and labouring

4.3.2 Role of women in aquaculture and impacts on livelihoods

Focus group discussions (FGDs) with the women in four sample villages followed by a questionnaire survey with 144 individual women allowed the individual perceptions of impacts of aquaculture to be assessed.

4.3.2.1 Women's role in integrated aquaculture

In all villages women were found to be involved in pond management activities. The proportion (%) of women carried out the most common activities is given in Table 4.7. There was no difference ($p>0.05$) among the villages regarding performing three activities, feed preparation, feeding fish and growing vegetable. However, the proportion of women did the hard physical work like pulling net during harvesting, and involvement in dike repairing and preparation for vegetable growing was much less, than the above mentioned three activities. However, the number of women involved in “repairing and maintaining” pond dike crops in Damgaon and Ayenakhet (more commercial, peri-urban aquaculture) averaged 35% and was significantly higher ($p<0.05$) than in Goatola and Koirahati (less commercial, rural aquaculture) (Table 4.7). Similarly a higher proportion of women were involved in seining fish at harvest in Damgaon and Ayenakhet (29%) was much higher than in Goatola and Koirahati (8.3%) ($p<0.05$).

Table 4.7: Aquaculture activities carried out by women

Aquaculture management activities	% of women involved in aquaculture activities in different villages			
	Damgaon (n=36)	Ayenakhet (n=36)	Goatola (n=38)	Koirahati (n=34)
Feed preparation	97.2	86.1	78.9	79.4
Feeding to fish	91.7	86.1	73.7	76.5
Vegetable growing	77.8	75.8	68.4	67.6
Preparing pond dike	38.9	30.6	18.4	8.8
Pull net for harvesting	36.1	22.2	10.5	5.9

4.3.2.1.1 Time spent on pond activities and workload

On average women spent 48 (± 31.26) minutes daily for aquaculture activities which was equivalent of 27% of the total time spent on-farm (3 hours daily) on agricultural production. However, there was a significant difference ($p<0.05$) in the mean time spent on-farm for four main agricultural activities for the villages (Figure 4.9). The mean daily time spent by the women for aquaculture for Damgaon and Ayenakhet

was 60 (± 35.21) minutes significantly higher ($p < 0.05$) than that of other two villages 37 (± 21.57) minutes.

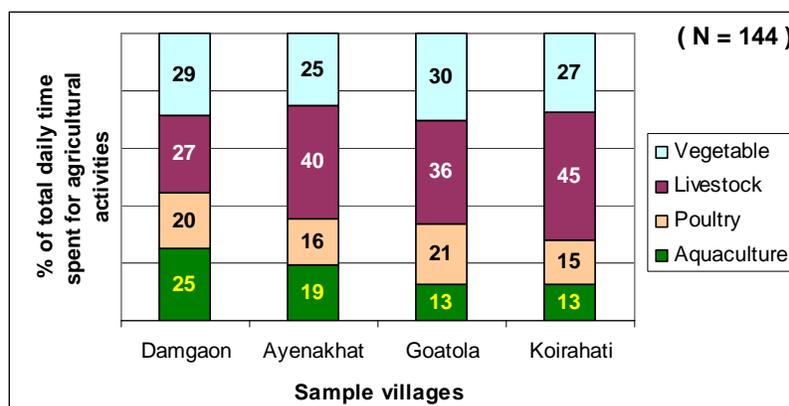


Figure 4.9 Time spent for various farming activities by women in sample villages

All women mentioned that involvement in aquaculture management activities increased their overall workload. Most women (84%) were satisfied to carry out these activities despite the increased workload, but some (16%) of the women expressed that they were not satisfied with the increase of workload considering their own situation. They faced the problem of being a labourer in aquaculture after taking care of children, the collection of cooking fuel and other domestic tasks.

There were a variety of reasons stated by the women for satisfaction with pond activities even though the overall workload was increased. The reasons were categorised for analysis (Figure 4.10). Overall 37.2 % women mentioned that increased income was the main reason for satisfaction. However, whereas, a higher proportion of (43%) of women from Damgaon and Ayenakhhet identified that increase of income was the main motivation and only 30% from Goatola and Ayenakhhet mentioned this reason. Fourteen percent of the women perceived that they were “helping their husband” to improve the household livelihood, while 10% women realised that they had to “work hard to maintain and improve livelihood”.

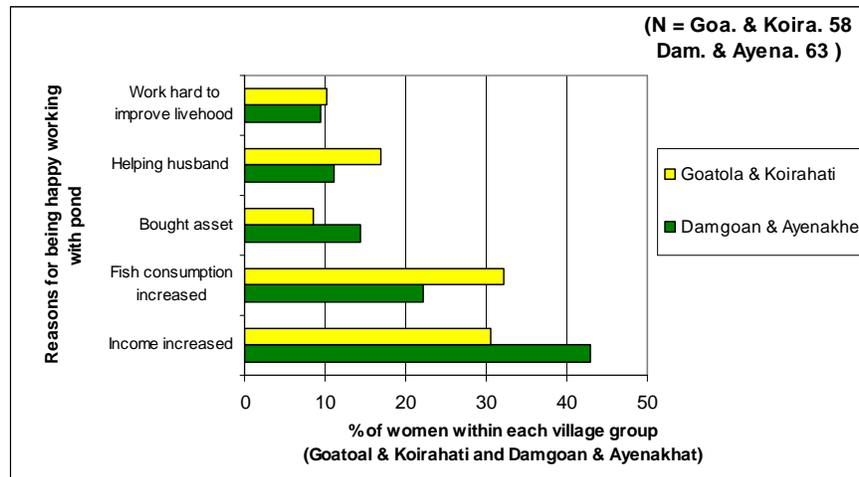


Figure 4.10: Reasons for satisfaction with participation in aquaculture activities

On the other hand “could not maintain household activities properly” was the main reason for being dissatisfied with the increased workload associated with aquaculture (Table 4.8).

Table 4.8: Reasons for being dissatisfaction with pond activities

Reasons for not happy	Number of women
Feel tired or sick	6
Could not maintain household works properly	10
Always busy, no time for relax	6

4.3.2.2 Involvement of women in decision making in aquaculture

The study assessed women’s role in the household decision making regarding aquaculture and found that 80% of the women were consulted by their husbands over such discussion. The rest (20%) did not feel that they had any active role in decision making. For the women who were asked about the subject matters, decisions were made following discussions and multiple subjects were identified (Figure 4.11). Overall, the major proportion of the women were found to be involved in decision making like, feeding fish (73%) and stocking fish seed (68%) (Figure 4.11). There was little difference between Damgaon and Ayenakhet villages, and Goatola and Koirahati in this regard.

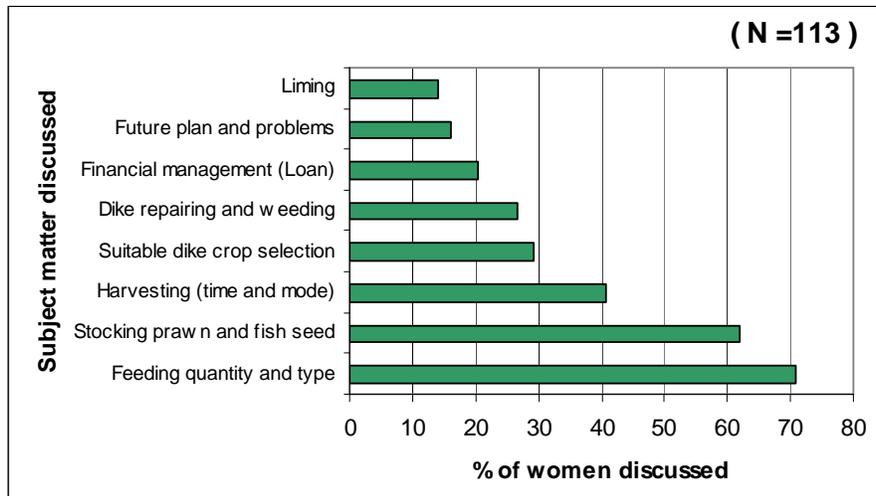


Figure 4.11: Proportion of women discussed various subject by their husbands

4.3.2.3 Financial decision making

Figure 4.12 shows that 66% women were involved in decision making regarding household expenditure. However, only 19% women had the freedom to spend even a small amount of money without consultation. There was little difference between the villages regarding decision making on household expenditure. The proportion of women involved in financial decision making from Damgaon and Ayenakhet was slightly higher than that of Goatola and Koirahati.

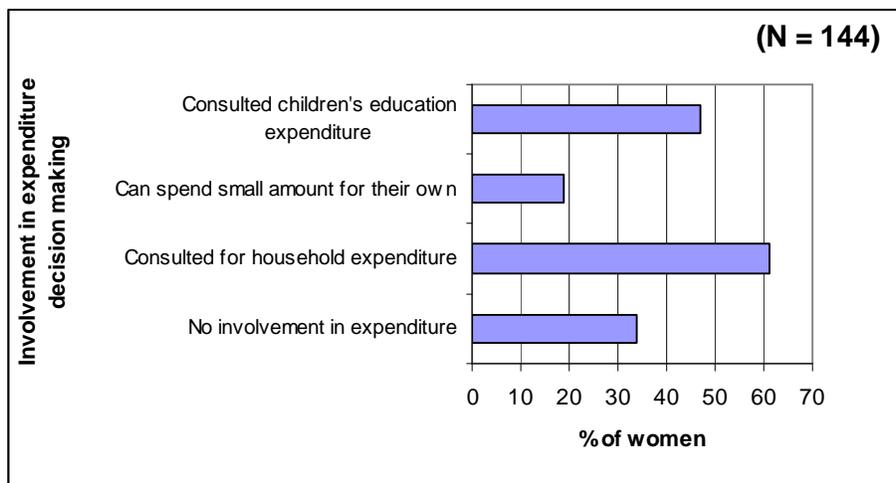


Figure 4.12: Involvement of women in household financial decision making

4.3.3 Fish marketing and its impacts on rural livelihoods

4.3.3.1 Farmers' marketing practices

Fish farmers in sample villages in Mymensingh had different options for marketing their fish. Individual fish farmers sold their fish through a variety of market outlets according to their requirements (Table 4.9 and Figure 4.13 and Figure 4.14).

Table 4.9: Mean number of markets used by farmers for sample villages

	Village distance from <i>paka</i> road	Auction markets			Retail markets		
		Number	Distance (km)	Transport cost (Taka)	Number	Distance (km)	Transport cost (Taka)
Damgaon	3.2	4	12.3	37	6	3.4	25
Ayenakhet	0.1	2	5	35	4	3	25
Goatola	0.5	3	10.6	47	5	2.5	21
Koirahati	0.2	3	20	33	4	3.5	28
Average	1.0	3.0	12.0	38.0	4.7	3.1	24.8

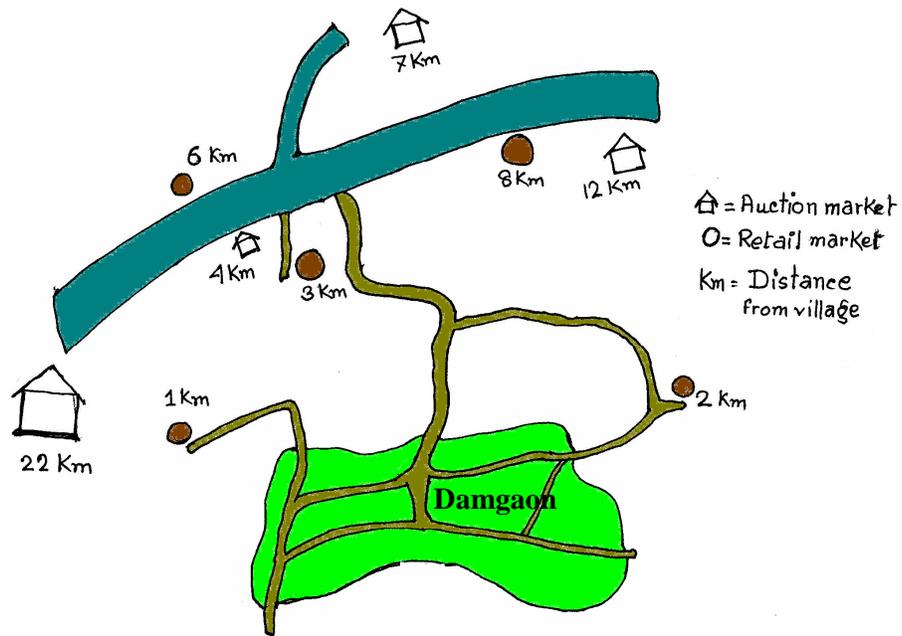


Figure 4.13: Position of markets used by Damgaon fish farmers

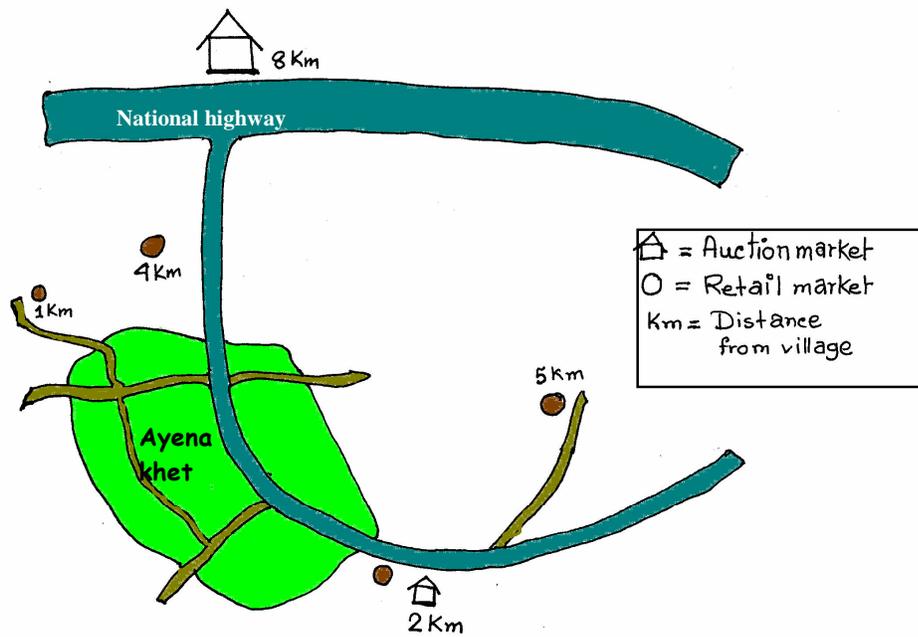


Figure 4.14: Position of markets used by Ayenakhet fish farmers

The proportion of fish marketed through different channels by farmers in the sample villages is shown in Table 4.10. In general, farmers from Damgaon and Ayenakhet sold most of their fish (78%) to auction markets, followed by Dhaka party (11%) and at retail markets (8%). Farmers from Goatola and Koirahati sold 60% of their fish to auction markets, followed by wholesale to retailers (15%) and 18 % sold at farm gate to fishers or *Nikari*. However, in FGDs farmers mentioned that they were selling more fish directly to markets, whereas in the past they used sell most fish to *nikari* at farm gate.

Table 4.10: Proportion of fish sold through various options by farmer's in sample

Village name	Selling at market (% of total quantity)		Selling at farm gate (% of total quantity)		Neighbour	<i>Nikari</i> /Fishers	Dhaka party
	Auction market	Retail market	Whole sale to retailers	Retail to consumers			
Damgaon	75	10	1	1	3	10	
Ayenakhet	80	5	0	1	2	12	
Goatola	55	15	7	3	20	0	
Koirahati	65	15	3	2	15	0	
Average	69	11	3	2	10	6	

Farmers tended to sell larger size fish (≥ 1.0 kg) and/or a large amount at auction markets and before the harvest they usually checked prices from other farmers. When the farmers harvested small size fish and/or small quantities they usually sold it at retail markets or to *Nikari*. In such cases, sometimes farmers often did not check prices. The study found that there was no formal market information systems where farmers could access price and demand information. Perennial pond farmers often planned to harvest fish in May-June when prices tended to be higher in the market. Some more commercial farmers established relations with auctioneers to access fish price information through mobile telephone.

4.3.3.2 Farmed fish marketing chain in Mymensingh, activities and people involved

An overview of the people involved at different levels for different fish marketing activities is shown in the Table 4.11 below.

Table 4.11: People involved in fish marketing and their main responsibilities

Position		Brief description/responsibilities
Local name	English	
<i>Nikari</i>	Middlemen	Collect (buy) fish from farmers at farm gate and sell at auction and retail markets. Usually <i>Nikari</i> buy fish within own village and neighbouring villages.
<i>Arot</i>	Auction house/market	Usually in the established markets there is fixed place for auctioning fish. There are few to several auction houses in a market. The individual auction house is called <i>Arot</i> .
<i>Arotder</i>	Auctioneer	Owner of individual auction house and runs the auction process. <i>Arotders</i> are the main investors in fish marketing.
<i>Paiker</i>	Retailer	Buy fish from auction markets by bidding and retails to consumers at retail markets.
<i>Sharker</i>	Manager	Employee of auctioneer and is paid monthly. Maintain records of all kind as required by auctioneer mainly financial records such as payments, providing credit, recovery etc.
<i>Koilder</i>	Assist bidding process	<i>Koilder</i> assist auctioneers in the bidding process. He also weighs fish for bidding.
Helper	Fish sorter	Sort fishes into different species and sizes, and weight them for bidding. He also sometimes helps in making loading and unloading fish.
<i>Kuli</i>	Labourer	Unload and load fish. Carry fish from vehicle to auction place and vice-versa.
Sweeper	Cleaner	Clean the auction market daily usually early in the morning before the auction starts. All sweepers are from lower cast Hindu.

The fish marketing chain identified during the tracking process was combined with the other marketing options used by farmers (from FGDs) to develop a more generic farmed fish marketing chain for Mymensingh district and is shown in Figure 4.15 and a general overview of the process found in the study is described below;

Fish farmers had different options to sell their fish, but in most cases the farmers sold their fish to auction markets (wholesale) locally called *Arot*. Retailers buy fish at such

auctions by bidding. Fish are then sold to consumers either at the retail market attached to the auction markets or transported to other retail markets.

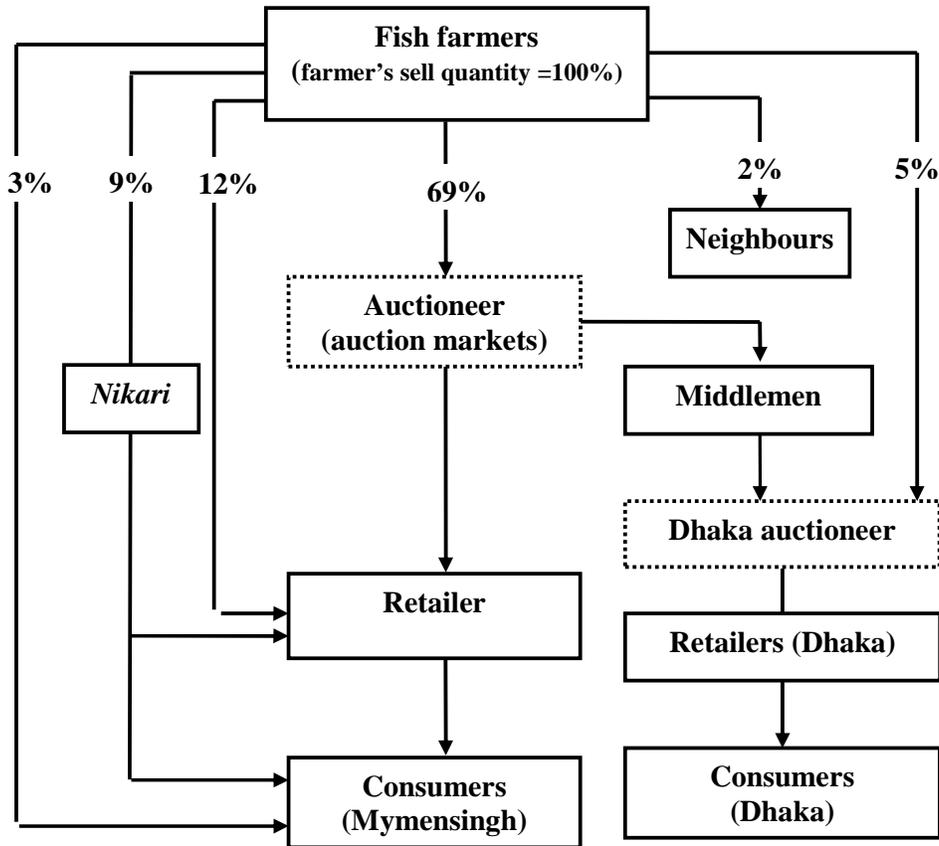


Figure 4.15: Farmed fish marketing chain for sample villages

In some cases farmers directly sell fish at retail markets, mostly rural retail markets. Farmers have two options to sold fish at retail markets, i) in most cases, farmers' wholesale their fish to professional retailers and then retailers sell fish on to consumers at the same market and ii) in a few cases farmers directly sell fish to consumers. Farmers also sold fish at the farm gate to *nikari*, who purchase fish (usually in small amounts), from different farmers and take them to retail markets. At retail markets *nikari* sells fish either to other retailers or retail directly to consumers. Since the last 3-4 years, farmers from Damgaon and Ayenakhet has been selling fish directly to Dhaka party (auctioneers from Dhaka markets). Dhaka party made contact

directly with farmers and buy fish at the farm gate. Fish from one of the four study auction markets (Trishal) was found to transport to other auction markets in Dhaka.

4.3.3.3 Fish marketing activities, processes, people involved and their role

A more general overview of the marketing processes and activities found in the study is outlined below;

After harvest, fish are washed with water and then (dead fish) transported to market. In most cases farmers hire (a manually pulled small three wheeler) for transporting fish. On a few occasions they carry fish to retail markets by bicycle. At the auction market, the farmer can choose any auctioneer to sell his fish, but usually one farmer sells fish through one particular auctioneer. A few value added activities are carried out in auction markets during the transaction including washing fishes to remove mud, sorting and grading according to species and size by eye estimation, weighing fish, loading and unloading. After auctioning, retailers take the fish on credit. Farmers are usually paid within 2-3 hours by auctioneer. Usually farmers pay commission to auctioneers at a rate of 3-5% of total auction price. Farmers also pay for market tax, cleaner, *Kuli* (unloading labour), water supplier etc. and the auctioneer pays his employees that typically include a *sharker* that are manager/accountant) and *Koilder* (auction assistant).

Table 4.12: Average cost for auction and retail markets

Cost items	Auction market (Taka/ton)	Retail market (Taka/ton)
Market tax	341	211
Auction commission	2275	0
Cleaner	211	279
<i>Kuli</i>	260	0
Helper	267	0
light	0	198
Water	118	81
Others	174	249
Total	3646	1018

Retailers selling fish near to the auction house pay back the auctioneers at the end of the day and if the retail markets are far way the retailers pay auctioneers when they take their next batch of fish the following day. In Mymensingh, retailers also pay commission at 3-5% of the auction price to the auctioneer. Most of the auction markets operate either in the morning or in afternoon, but some operate in both periods with a break at noon. The operating times depend upon where most of the fishes are retailed. The Trishal auction market operates during the afternoon as most fishes are transported to distant markets such as Dhaka and are sold next morning. Fish are iced when they are transported for more than 2-3 hours, particularly in the summer.

4.3.3.4 Marketing margins: share of consumer's price

For collecting data on marketing margins in Mymensingh, 45 retailers with fish were followed from the auction process to the final consumer at retail markets. In all cases fish was transported and sold directly to consumers at retail markets. On average one retailer traded 27.3 (\pm 20.65) kg fish daily buying from auction markets at Taka 45/kg (USD 733/t) and made Taka 233/day (\pm 163) (USD 3.2) net profit (at USD 172 /t). Consumers paid Taka 60/kg (\pm 51) (USD 1027/t) at retail markets. From those transactions farmers received 65% of the price paid by the final consumer (Figure 4.16). Auctioneers received 8% of consumer's price at USD 66.89/ton (\pm 21.04). One auction house transacted about 363 kg/day on average. The people providing support at auction and retail markets, and transport shared 4% of the price paid by consumers. The support people included helper, water suppliers, ice suppliers, market and transport *Kuli* and cleaner and they were paid individually by individual farmers or retailers and/or auctioneers. Transport costs (retailer and fish) comprised 5% of consumer's price.

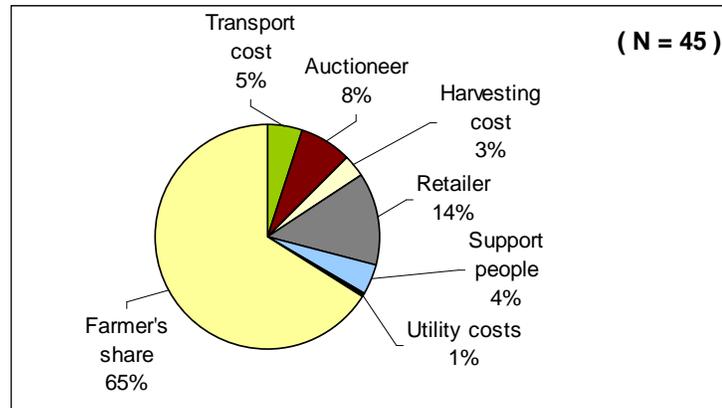


Figure 4.16: Percent share of consumer's price received by stakeholders including farmer

4.3.3.5 Growth of rural fish markets

In FGDs with retailers it was established that fish were not only sold in the formal fish markets, but also at many roadside places. There were a total of 135 markets including roadside places where fish was sold regularly or on specified market days within a 10 km radius of the four sample villages. More than a quarter of these markets had been established during the last the 10 years (Figure 4.17).

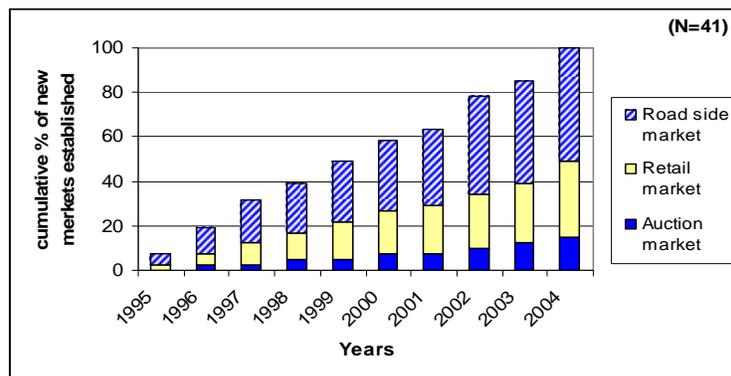


Figure 4.17: Cumulative % of new fish markets established with in 10 km radius of sample villages during 1995-2004

4.3.3.6 Employment in fish marketing

Four auction markets, where the farmers (from two sample villages) sold most of their fish were studied in details to access employment in fish marketing. On average 99 (± 77) people (including retailers) worked in each auction market. The composition of

the various types of activities in these and people involved is shown in Table 4.13. *Koilder*, *Sharker*, *Kuli*, helper were employed by auctioneer. Sweepers were contracted by market organizers, but were also paid by farmers. It is important to note that some retailers buy fish from different auction markets and retail at different retail markets on different days.

Table 4.13: Composition of stakeholders in auction markets in Mymensingh

	Gouripur	Mymensingh	Trishal	Kalirbazar	Total
Auctioneer	6	16	10	3	35
Retailer	35	155	45	27	262
<i>Koilder</i>	1	6	11	2	20
<i>Sharker</i>	2	10	11	2	25
<i>Kuli/Helper</i>	5	16	9	2	32
Water suppliers	1	3	2	0	6
Cleaner	2	3	2	1	8
Ice supplier	0	2	3	0	5
Tax collectors	1	1	1	1	4

On the other hand, most retail markets consisted mainly of retailers (averaged 25 but ranged from 12 to 42), cleaner (1) and tax collector (1) (employee of market lease holder) for each retail market.

Table 14: Asset profile of marketing stakeholders in two groups

Physical assets	Employees Mean \pm Stdev	Employers Mean \pm Stdev.
Family size	5.8 \pm 1.9	6.1 \pm 2.3
Household head age (years)	39.8 \pm 11.2	46.6 \pm 15.1
Household head (5-12 class) %	35%	89%
Land holding (ha)	0.17 \pm 0.14	0.43 \pm 0.33
Cattle (number)	1.2 \pm 1.22	2.83 \pm 1.95
Goat (number)	2.10 \pm 1.4	1.23 \pm 2.10
Poultry (Chicken & duck) number	18.21 \pm 8.6	18.10 \pm 8.17

The assets base shown in Table 14 indicates that 91% of stakeholders (except auctioneers termed as “Employee” in Table 4.13.2) were very poor.

Results of the questionnaire survey of 157 intermediaries in fish markets used by the farmers (4 auction and 5 retail markets) surveyed shows that some of the intermediaries had been working with fish marketing for 45 years, but it averaged

13.18 (± 10.57) years. Of 157 sample stakeholders 81 (51.6%) started working with fish marketing within the last 10 years. Cumulative percentages of stakeholders working with fish marketing for different years showed a gradual increase of people in marketing chain in Mymensingh during 1990 – 2004 (Figure 4.18).

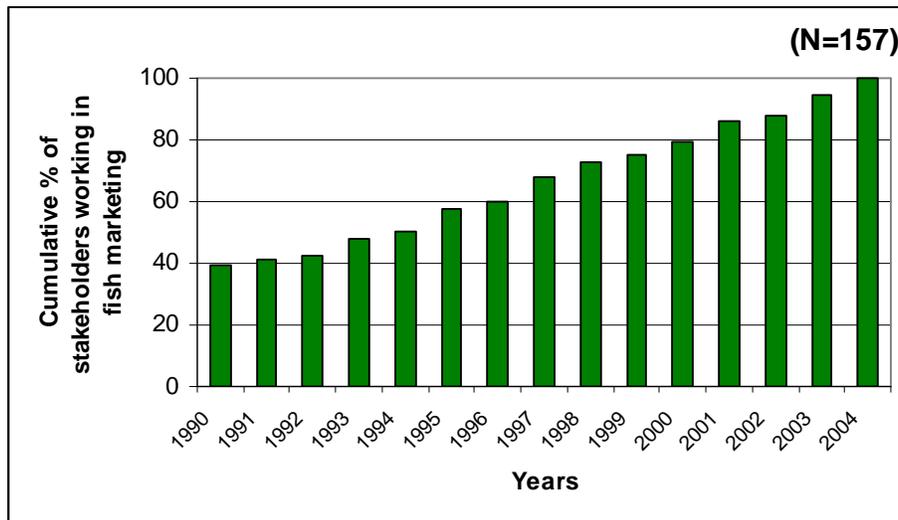


Figure 4.18: Cumulative % of stakeholders involved in fish marketing during 1990-2004

4.3.3.7 Access to job opportunities in fish marketing:

The previous employment of market-based stakeholders and their reasons for changing jobs were investigated. The result shows that the stakeholders had a wide range of previous working backgrounds (Figure 4.19).

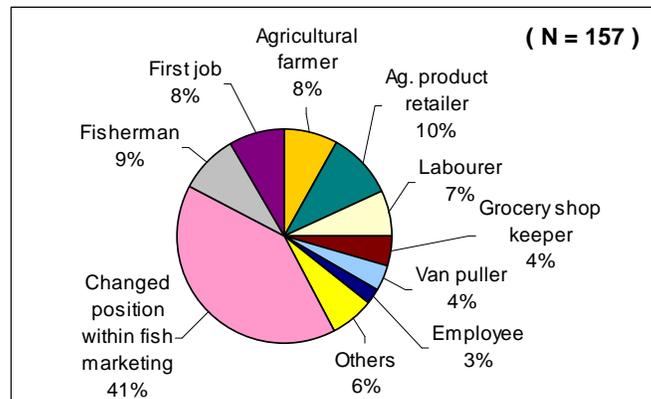


Figure 4.19 Last job/profession for fish marketing stakeholders in Mymensingh

Figure 4.19 shows that 51% of the people working at fish marketing in Mymensingh had different backgrounds and 41% changed their position within the marketing chain and the rest (8%) started their professional career with fish marketing. Retailers of agricultural products other than fish comprised the highest proportion (10%) among the stakeholders from other background and closely followed by farmer, fishermen, and labourers.

4.3.3.8 Reasons for seeking job in fish marketing i.e. changing last job

There were a variety of reasons for stakeholders to become involved in fish marketing. The reasons were grouped under 9 major categories and presented separately for the people changed position within the marketing chain and the people joined from outside of the fish marketing chain in Figure 4.20.

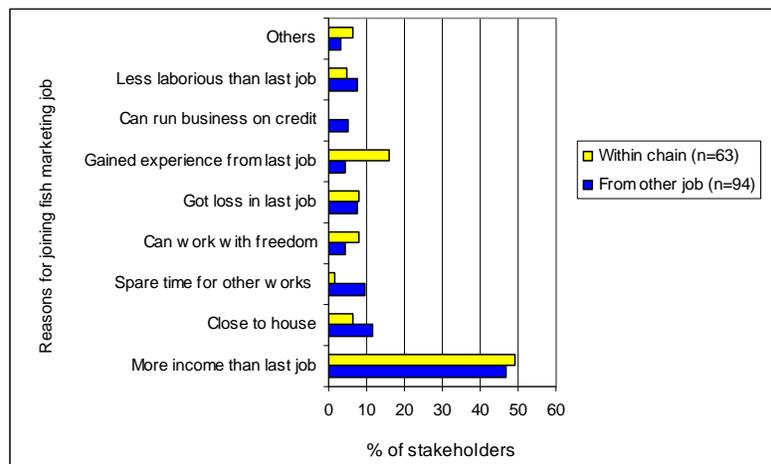


Figure 4.20: Reasons for seeking job in fish marketing (i.e. changing last job)

Forty seven percent of the marketing stakeholders mention that “more income than last job” was by far the most important reason for joining in marketing jobs. Market-related employment being “closer to house” was second (12%). On the other hand, nearly fifty of the people who changed position within the chain also mentioned that “more income than last job” was the main reason for changing position or markets. “Gaining experience in fish marketing” was second (16%).

4.3.3.9 Impact of fish marketing on livelihoods of stakeholders

Fish marketing stakeholders in Mymensingh were asked about their annual income and its sources. The results shows that 21% of the stakeholders had only one source of income i.e. income derived within fish marketing networks, 39% had two sources, 35% had three sources and only 5% had 4 income sources. However, income from serving fish marketing contributed the major proportion (73%) to household incomes for the stakeholders (Figure 4.21) and was significantly higher ($p < 0.05$) than that of other sources. Auctioneers income from marketing was significantly higher ($p < 0.001$) than other stakeholders.

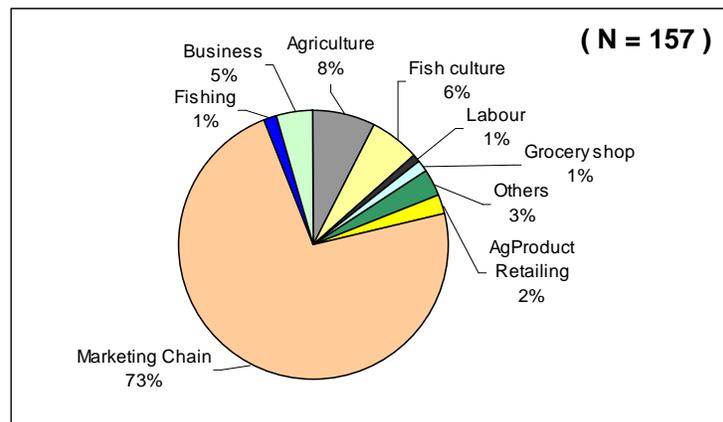


Figure 4.21: Proportion of household income from different sources for fish marketing stakeholders in Mymensingh

The annual mean household income varied among different level of stakeholders in fish marketing chain (Figure 4.22). The annual mean household income of auctioneers Taka 277,362 (4474USD) was the highest and of the cleaners Taka 36084 was the lowest among the stakeholders. The annual mean income for other marketing people other than auctioneer and varied between Taka 36084 (USD 582) and Taka 72850 (USD 1175).

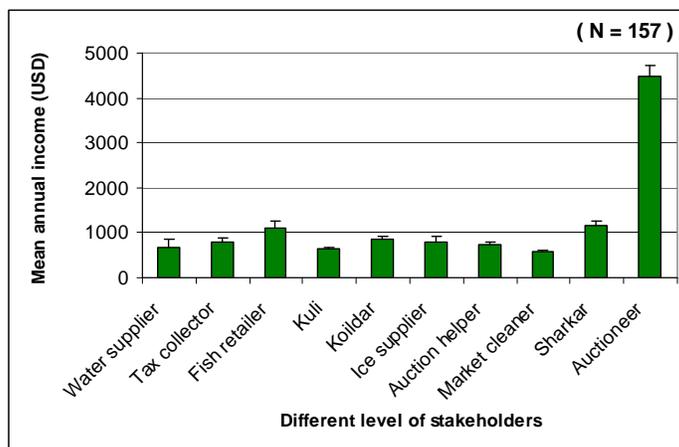


Figure 4.22: Mean annual household income for different marketing stakeholder

4.3.3.10 Improvement in livelihoods of marketing intermediaries:

Stakeholders were assessed regarding changes in household livelihoods during the last five years and the factors that influenced the changes. Livelihood changes are grouped into three; i) improved, ii) remained similar iii) deteriorated and are presented separately for auctioneers and other stakeholders together (termed as “employee”) in Figure 4.23.

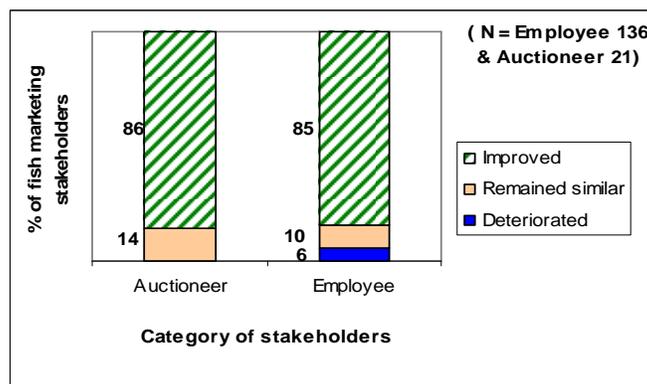


Figure 4.23: Change in livelihood outcomes fish marketing stakeholders over the last 5 years

Household livelihood outcomes of 85% of the fish marketing stakeholders were improved over the last 5 years and remained similar for a farther 10% and deteriorated for 6% of stakeholders. There were no remarkable differences among the different stakeholders groups regarding changes of livelihood outcomes (Figure 4.24).

Stakeholders pointed out that a combination of multiple factors contributed to improved livelihood outcomes, which are grouped into 9 main categories and shown against auctioneers and employees in Figure 4.24. The majority of employees (86%) and auctioneers (81%) mentioned that “income from fish marketing” employment contributed to improving livelihood outcomes, followed by “income from agriculture” (21% for employees and 43% for auctioneers). Twenty four percent of the auctioneers mentioned that they “established their own auction business” which contributed to improving their livelihood outcomes.

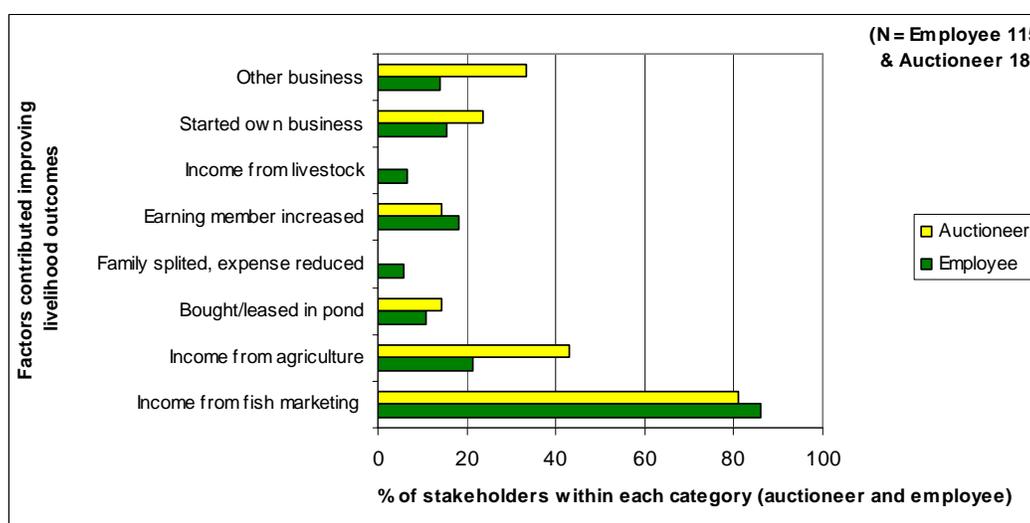


Figure 4.24: Factors contributed to improve livelihood outcomes for marketing stakeholders

The main causes for livelihoods remaining similar or deteriorating were variable (Table 4.15 and Table 4.16 respectively). There were not many differences observed between the two stakeholders groups in terms of these reasons.

Table 4.15: Reasons for livelihood outcomes remained similar for intermediaries

Factors caused to livelihood remained similar	No. marketing stakeholders	
	Auctioneers (n=3)	Employees (n=13)
Family split	-	1
Family member increased	-	2
Income decreased	1	1
Business reduced	1	-
Ill health-income reduced	0	2
Income/salary not increased	1	3
Expenses for daughter/sister’s marriage	-	2
Household expenditure increased	-	2

Table 4.16: Reasons for livelihood deteriorated for marketing stakeholders

Factors caused to livelihood outcomes got worse	No. of employees (n=8)
Income decreased	2
Business reduced	1
Income/salary not increased	1
Expenses for daughter/sister's marriage	1
Household expenditure increased	1

The stakeholders mentioned improvement in multiple outcomes in reference to the overall improvement in living status. The outcomes are grouped and presented in Figure 4.25. There was a remarkable difference ($p < 0.001$) between the employees and auctioneers improvement in food consumption and clothing. Food (quality and quantity) and clothing were improved for 84% and (83%) employees respectively. Social outcomes like social visit to friends or relatives (43%), “observing festival with proper manner” (37%), marriage of daughter/sister” (24%) and social honour by repaying loan (19%) were found to be important for employees. On the other hand improvement in savings (61%), health care (76%), education (58%) and housing (48%) were the main improved out comes for auctioneers (Figure 4.25)

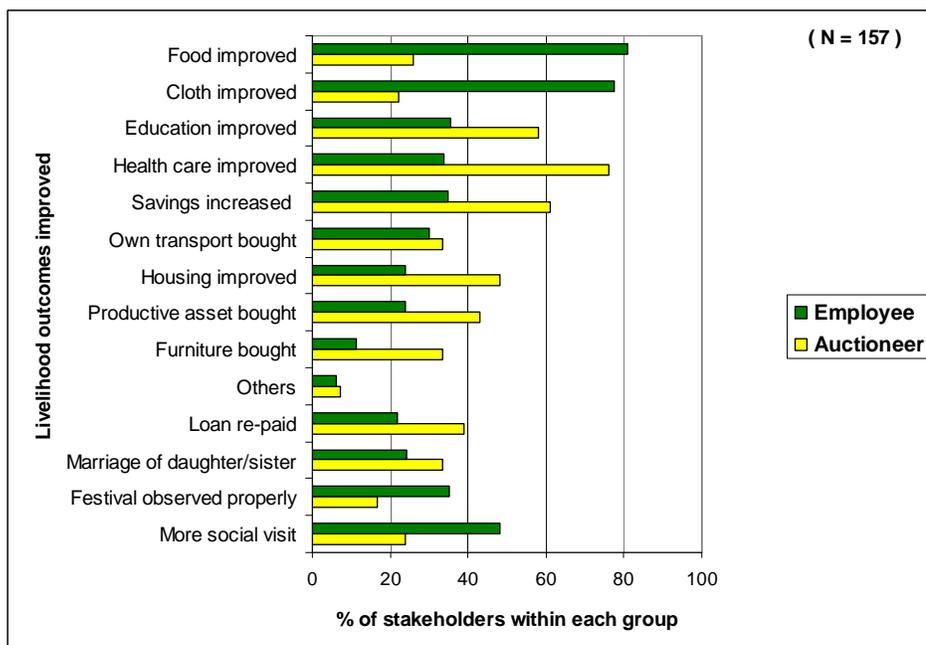


Figure 4.25: Livelihood outcomes improved for marketing stakeholders in Mymensingh

4.4 Discussion

Results obtained and presented in section 4.3 of this chapter on freshwater aquaculture in Mymensingh confirm that small-scale conventional aquaculture production and marketing had significant impacts on rural livelihoods. Intensification of fish production along with integrating pond-dike vegetables certainly improved livelihoods outcomes of farming households through increased farm outputs (Karim 2006). The impacts spread beyond the farming households to wider livelihoods. However, the impacts were greater for some groups than others. The study covered producers and non-producer groups in the communities who were directly employed in aquaculture. Details of the findings are discussed in three main headings below.

4.4.1 Livelihood impacts of small-scale pond fish culture at village level

4.4.1.1 Impacts on farming households

The contribution of home based conventional aquaculture was found to be significant to household consumption, income and household labour distribution for the fish farmers in Mymensingh. Several studies suggest that small-scale rural aquaculture has diverse roles towards the improvement of livelihoods; potentially it can contribute to improving household food security and supplementing family income of the poor (Little, 2000; Muir, 2003). Even if practiced at a subsistence level, aquaculture could provide much needed animal protein and other elements of diets the lack of which are typical causes of malnutrition.

The household's own pond was found to be an important and instant source of fish for household consumption. Slightly less than two thirds of the fish consumed by the farming households were sourced from their own pond, which was much higher than those other the main sources (market and wild caught). Alam (2002) found that half of the fish consumed by the farmers practicing carp polyculture were from their own

pond. However, the proportions of fish consumed from their own pond by worse-off farmers was less than that of better-off farmers. Two reasons can be noted; firstly the worse-off farmers tended to sell high value fish and buy cheaper fish for home consumption (Karim 2006). Alam (2002) found that consumption of more valuable cultured fish like rohu, catla and mrigal was higher for the better-off. Torlesse et al. (2004) suggested that increased production did not necessarily tend to increase consumption. Secondly; wild caught natural fish contributed a good proportion of household consumption of worse-off farmers. Consumption of natural fish also allowed worse-off farmers to reduce consumption from their own pond and increased fish sales (Alam, 2002). This indicates that natural fish remains an important source among the poorer section of rural people. In a recent study Islam (2007) found that 21% of the fish consumed by fish farmers was wild caught.

The per capita annual fish consumption of this study (13.6 kg) was slightly lower than the findings of the study of MAEP (14.03 kg/capita/year) in Mymensingh (DANIDA, 2004), and than (13.9 kg/capita/year) found in the national household expenditure survey (BBS , 2001a). Importantly the per-capita consumption did not differ considerably between worse-off and better-off households, indicating that household consumption benefits were similar among pond aquaculturist. Drawing data from the WorldFish Center Project Alam (2002) shows that mean annual per capita fish consumption of poyculture farming households was 19.5 kg.

Income from selling fish was another significant contribution of pond aquaculture to farming households. The study found several sources for household income among fish farmers, but they primarily relied on agriculture. The resource poor rural people in developing countries often diversify their livelihoods for income security and spread the income risks (Ellis 2000b; Sen 2005). However, the study evolved that, although farm products (64%) dominated the overall household income for fish farmers, the contribution of fish culture (21%) ranked second following income from rice (29%). The annual household income Taka 79,708 (US\$ 1285) revealed from this

study was slightly higher than the national income (1,168.37/hh/year) of 2000 (BBS, 2004). Yet it was slightly less than Taka 89,840 (actual Taka 79,122, weighted with inflation) that was found by DANIDA for fish farmers in 2001 in Mymensingh (DANIDA, 2004). Income from fish was not only found to be important for livelihoods, but also it was sometimes used for the coping of short term risks or needs (like illness). Fish in the pond is considered as liquid asset as fish are sold during times of need especially during the wide seasonal variations in agricultural production cycles and sudden needs (Brown, 2001).

Aquaculture by increasing income and fish consumption contributed to improving overall livelihood security through increasing the asset base. While assessing the impact of fish culture in ponds in several districts in Bangladesh, Brown (2001) found a positive relation between increase of fish production and households assets. He found that from increased income farmers purchased livestock, housing and health care and in a few instances the ability to grow fish commercially resulted in some farmers leasing more ponds from other farmers or the construction of new ponds. Thus pond aquaculture in Mymensingh is supporting improved livelihoods of pond farmers in a way that invests in a broad range of livelihood assets.

4.4.1.2 Livelihood impact on aquaculture labourers

Aquaculture impacted broadly on rural livelihoods in Mymensingh and employment in more commercial aquaculture has been greatly stimulated. Farmers used to hire labour occasionally for re-construction of pond dikes and excavation of sediments, usually in the dry season. Therefore, hire labour for fish farming compared to total agricultural labour was marginal in the past (Ahmed et al. 1993). Intensification of aquaculture in the Mymensingh region with greater commercial attitude led farmers using more pond inputs, including hire labour for pond management (ADB, 2005; Thompson et al. 2006).

The study found that aquaculture had a considerable impact in the rural agricultural labour market. Intensification of fish production systems along with integrating intensive vegetable production on pond-dikes of small-scale farms had increased labour demand in households with fish ponds. The farmers employed labourers for different pond management activities, beyond the traditional dry season pond work, which affected the agricultural labour structure at village level. Half of the agricultural labourers were found to be employed full-time or part-time in aquaculture suggested a structural change of agricultural labour market in the sample villages. Ahmed (1993) noted in many Asian countries development of aquaculture, supported by expanded domestic and international markets, increased household participation, changed labour use patterns, as well as increased employments leading to an occupational shift for many people. Growth of highly labour-intensive horticulture and horticultural processing in Mexico during 1990s, particularly tomato production and processing, increased labourer requirements by more than 20%, which resulted in a higher labour migration to tomato producing regions from other regions and led to a structural shift in agricultural labour markets (Barron and Rello, 2000). The study found such changes in labour markets was more prominent in two villages. A much higher proportion (65%) wage labourers in Damgaon and Ayenakhet were involved in aquaculture labourers than the other two more rural villages Goatola and Koirahati (42%). The more commercial peri-urban aquaculture in Damgaon and Ayenakhet explains this differences.

Labour demand and employment opportunities increased over the years. The study revealed that the opportunity had increased from 2 days/week to 4 days/week over the last 10 years. Again these opportunities were greater in Damgaon and Ayenakhet (5 days/week) than that of Ayenakhet and Koirahati (3 days/week).

The employment needs to relate to wider rural livelihoods context for labourers (explained in earlier in 3.4.2.1), in which the opportunities generated in aquaculture helped diversify on-farm employment for wage labourers resulting in enhanced

livelihood security for them. Agricultural labourers are typically affected by seasonal variation in cropping patterns. Therefore, seasonal migration is widespread in Bangladesh and other developing countries (Sahn, 1989). But agricultural diversification and change in crop patterns in recent years together with increased transaction and living cost much affected the seasonal manual labour migration (Deshingkar, 2004). In this context the employment in aquaculture was critical for labourers as more consistent opportunities for wage labour had reduced both advanced selling of labour and migration for work in vulnerable months. Pond based employment reduced the lean period from approximately four months to two months. Some of the skilled labourers had almost permanent employment with more commercially operated farms in Damgaon and Ayenakhet.

As a result of increased demand of labour and work opportunities, real labour wages had also increased by about 47% for aquaculture labourers over the last 10 years. Weinberger and Genova (2005) found that commercialization of vegetable production in two thanas in Bangladesh (Savar, Dhaka and Shadar, Jessore) increased employment opportunities, which subsequently shifted real labour wage upwards.

The impact of working with ponds for labourers was not limited only to employment and wage increases, but also enhanced fish consumption and social security. The fish given to labourers by fish farmers as incentives were an important part of the overall benefits as it comprised one fourth of household fish consumption (by weight) for labourers. Exchange of food or farm product gift are part of rural Bangladeshi culture (Ali and Niehof, 2004; Islam, 2007). Yet more importantly, such incentive fish were significant for smoothing fish consumption in winter months when there was no opportunity for catching natural fish as the water bodies dry up. Thompson et al. (2000) observed that about 75% of rural households in Kishorgonj caught wild fish from small *beels* on roughly 50% of days during the rainy season, which was the main source of fish consumed during that period. In addition to consumption smoothing, incentives help to maintain a good relationship between farmers and labourers, which

in turns enhanced the social safety net for labourers. Labourers reported that they could borrow money from farmers for a short period due to improved social relations and employment security. Devereux (2001) suggested that deterioration in the patron-client relation as a cause of increased vulnerability for the rural resource poor. Conversely, farmers also benefited from these improved relations with labourers through ensuring required labour during peak harvesting time.

Thus the employment and other benefits impacted in improving the overall living status as well reduced vulnerability of the majority of labourers employed in aquaculture. More than three quarters of the labourers confirmed that their food, clothing and housing had improved through involvement in over the previous 10 years.

4.4.1.3 Impact of fishers

A general livelihood condition of professional fishers is outlined in Chapter 3. The livelihoods condition of fishers in Mymensingh was no exception. The socio-economic conditions and the vulnerability context of fishers was more or less similar throughout the country (Rahman et al. 2002). Islam et al. (2006) studied livelihoods of fishers living around nine natural *beels* in different parts of the country, including two *beels* in Mymensingh and Kishorgonj and found that fishers possessed very few capital assets, most of them are landless, have poor fishing assets and lack other productive capitals. Their income from fishing has been declining over the years due to declining natural stock, and reduced access to natural water resources (Rahman et al. 2002; Toufique, 1998).

In this context, the study found that development of aquaculture, as a whole, impacted significantly on professional fishers' (as member of pond fish harvesting team) livelihoods. Intensification of fish production by small-scale farmers provided them with the opportunity to become almost fully employed harvesting the numerous and productive pond over the last 10 years. Thus aquaculture greatly helped fishers to

smooth income by diversifying their employments (Ahmed and Lorica, 2002). However, the employment opportunities were related to the level of intensification and differed between villages. The opportunities were much higher in Damgaon and Ayenakhet, where farmers operated their farms more commercially than the other two more rural villages. This can be attributed to multiple stocking and harvesting of fish practiced by more commercial farmers and their greater yields.

Fishers were also found to diversify their incomes by involvement in part-time fish retailing, when there was less opportunity for harvesting both in aquaculture and open waters. Dry season (January-April) is the lean period for fishers as most the openwater bodies dry up and catching wild fish is greatly reduced. Many fishers became involved in fish retailing during this period. Rahman et al. (2002) describes the dry season was the hardest time for fishers living on Brahmaputra river in Mymensingh and the fishermen push to become day labourers in agricultural and construction sectors. The current study found that one third of the fishers from sample villages were involved in part-time retailing. Some others (17%) worked with ponds for farm management tasks other than fish harvesting. Household income data for fishers collected by Islam et al (2006) indicates that fishers in Kishorgonj had several incomes sources. In the same study they found fishers diversified their livelihoods to agricultural wage labour (74%), non-agricultural labour (4%), petty trading (13%), and rickshaw or van pulling (4%) to cope with seasonal employment variability (Islam and Barman, 2004).

Increased opportunities for harvesting ponds certainly increased interactions between fishers and fish farmers. Fishers' communities are commonly featured as marginalized group in the society living around natural water resources with low level of human capital and social interaction with others (Kleith et al. 2003). Diversification of livelihoods greatly enhanced their social networks and mobility. While pond harvesting opportunities increased interaction with fish farmers, fish retailing increased their mobility and networks with marketing people. Increase of

social networks enhanced access to credit and part-time employment opportunities for fishers (Islam et al. 2004a). Social networks and relations are extremely critical for fishers to gain access to common pool water resources for securing livelihoods as most cases fishers suffering to gain access to common water resources (Toufique, 1998).

The only negative impact of aquaculture stated by the fishers was the reduction of open water fishing ground in the rainy season. Expansion of aquaculture into *beel* areas reduced their access both in terms of area and rights to catch fish. Although most of the *beel* lands are privately owned, previously those were open-access fishing ground in the rainy season. Introducing aquaculture into many of these lands by constructing high dikes greatly reduced access to common fishing ground for fishers and other rural poor. Property rights and access to open water resources was also an issue for fishers throughout the country (FAO, 2001c).

The increased demand of harvesting ponds with multiple harvesting practice led to increased real daily labour wage of more than 50% after adjusted with inflation over the last 10 years. In a study in Mymensingh, Rahman et al. (2002) found that fishers' daily earning from fishing fluctuated significantly and 64% of them earning, Taka 50-70 (US\$ 1= about Tk. 57), more than a quarter earned less than Taka 50 per day and only 10% earned more than Taka 200 daily. The increased income from pond harvesting together with diversified incomes through retailing fish and other wage labour during the lean period greatly contributed in improving living status of the majority of fishers in Mymensingh. More than three quarters of fishers confirmed that their basic needs, particularly food consumption, clothing, housing had been improved in the recent past.

4.4.2 Role of women in integrated aquaculture and impacts on women

4.4.2.1 Women's involvement in aquaculture

Womens' roles in aquaculture were found to have shifted from household based activities to labour intensive farming systems. Women from the fish farming households in study villages in Mymensingh were found to be involved in carrying out fish and dike vegetable management activities. Performing of agricultural activities, in addition of household activities, is a long tradition for rural women; particularly those do not require mobility far from the homestead such as poultry, home gardening, post harvest crop processing etc. (Paul and Saadullah, 1991). In a study in Bangladesh Talukder et al. (2001) found 73% of the women have dominated practice of homestead gardening. In an other study Quisumbing and Brière (2000) found that the all women (wives) from rural households in Mymensingh were involved in poultry management, with 80% of them actually owning the poultry. This study found that more than three quarters of the women were involved in feed preparation and feeding fish, and growing pond-dike vegetable regardless of the subsistence or commercial orientation. Active participation in these activities can be related to its similarity to rearing livestock and chicken, which involves preparing feed for cattle and chicken, feeding and cleaning, involvement in home gardening, processing and preservation of seeds (Dolberg, 2003; Oakley and Momsen, 2005).

Elora (2004) explained women's increase involvement in commercial poultry and vegetable production with declining per capita natural resources, increasing population and reduction in rice husking activities and in-house cottage industries. The current study found a greater involvement of women in aquaculture at the time of harvest and repairing dikes which are non-traditional roles, although fewer women undertook such tasks it clearly demonstrated the feasibility of more physical and divers roles of women in aquaculture. While women in Bangladesh initiated these physical activities, women in many other Asian countries carry out a wide range of

production and post-harvest activities (Sharma, 2003), which includes working in fish hatcheries, production managements, fish processing, drying and marketing (Akpaniteaku et al. 2005).

Women's involvement in different productive activities and time allocation is largely determined by the individual household economic condition and resource base (Kevane and Wydick, 1999; Ali and Niehof, 2005). More commercial intensified aquaculture operations had led women to participate more in production activities. Two stands of evidence of the study can be put forward, firstly the greater number ($p < 0.05$) of women involved in seining and repairing pond dike in villages with more intensive aquaculture (Damgaon and Ayenakhet) than that of less intensive rural villages. Secondly the time spent on aquaculture in more intensive aquaculture villages was much higher ($p < 0.001$) than that of the less intensive. Fontana (2003) found that by changing employment opportunities and earnings patterns of women and men, trade liberalisation influenced the allocation of time and resources among household members in some African countries. She observed an increase in the market value of a woman's time would lead her to spend more time on market-oriented activities. However, the current study revealed that the women spent about an hour daily for aquaculture and dike vegetables, which was about one thirds of the total time spent for agricultural activities as a whole, nevertheless indicating the earning importance of aquaculture in the household economy.

In Bangladeshi society, individual roles are related to the socially assigned positions, which affects the allocation of time and work, resources, decision-making and power within the family and society (USAID, Undated). Rural women have to perform all household activities; there is no choice for them. Therefore, greater involvement in aquaculture activities certainly increased women's overall workload. All women expressed that increased participation in aquaculture was additional to their normal daily household activities. In a study in Manikgonj, Bangladesh Ali and Niehof (2005) found introduction of new crops like tobacco and maize has increased the

overall workload of women participating in the production and processing of the crops.

Increase in workload through involvement in aquaculture had implications for properly managing households' activities, particularly in the care of children. Sixteen percent of the women expressed dissatisfaction with increased workload. Ali and Niehof (2005) found that women's involvement in vegetable cultivation and livestock rearing programs had to compromise in either child care or leisure time. Levinson et al. (2002) reported that women faced greater difficulty managing childcare during time-intensive seasons such as harvest. As women consider that childcare is a first priority, they often sacrifice their leisure time and/or sleep less (Levinson et al. 2002). The study found that more women involved in aquaculture were dissatisfied with the reduction in leisure time.

Despite a small proportion of women being unhappy by the increase in workload, the majority (84%) of women were satisfied with the extra burden of aquaculture activities, considering the overall welfare gains to households brought through increased consumption and income. In a study of the northern districts of Rajshahi, Nator and Cuahdunga (Alam, 1997b) found that small-scale poultry operations, mainly operated by women, increased household income, while there were also direct and indirect impacts on food consumption. He found a significant increase in egg (from 1.8/week to 4.6/week) and meat (1.2 kg/year to 5.6 kg/year) consumption as a direct impact during two years of interventions, while consumption of other foods like fish, beef, and rice also rose in line with increased income. In another study in Faridpur and Gopalganj, Darudec and Danida (1997) found that homestead gardening and poultry rearing increased egg and vegetable consumption for farming households. He also found that children ate more eggs than adults. Seeberg (2003) reported that women involved in poultry and goat rearing through government projects in different parts of Bangladesh were able to increase income and 50% of them were able to increase food security by ensuring three meals per day instead of two. Karim (2006) also found that integrated poly

culture of fish increased household fish and vegetable consumption of farmers. The study confirmed a significant proportion of households' fish and vegetable consumed by fish farmers was sourced from the ponds.

4.4.2.2 Financial decision making

Inequality between men and women can be reduced by empowering women both within the household and society as a whole. While there are several factors that affect women's status in households and society, this can be best achieved by increased participation in economic activities (Bahar, 2001; Lindgren and Mahal, 2001; Ueyama, 2006). This study suggested that women's greater participation in aquaculture in Mymensingh district enhanced their roles in household decision making. The majority of the women were involved in household decision making in several aspects, particularly those related to aquaculture production. A number of impact studies on women's micro-credit program in Bangladesh provides evidences that women's decision making capability and participation was increased due to involvement in household based small-scale poultry, livestock, vegetable production, and plant nurseries (Kabeer, 2001; Talukder et al. 2001; Ueyama, 2006). However, decision making capacity is also influenced by participation in other NGO activities such as training, group meetings, awareness programs etc (Kabeer, 2001).

Pond activities like fish feed preparation, feeding, storing feeds and growing vegetables were the most frequently discussed matters with their husband. This was due to active participation for higher proportion in these activities. In addition, it can also be attributed to women's experience in feeding cattle and chicken and homestead gardening. Involvement in home gardening, processing and preservation of seeds also is a long tradition of rural women. Talukder et al (2001) found that the majority of the rural women were the main decision-makers for the crops and use of the income earned by selling homestead garden products. The current study observed a the higher proportion women's involvement in decision making on harvesting fish and dike

repairing in more commercially operated villages can be explained by their higher participation in these activities. This is further evidence that women's participation in economic activities like aquaculture has a role in their empowerment.

In general, participation in income generating activities increased women's involvement in financial decision making (Schuler et al. 1996; Hashemi et al. 1996). Women's relative control of income and property affect their degree of empowerment in relation to family and society decision making (Lindgren and Mahal, 2001). The study found that one thirds of the women involved in aquaculture were able to secure some money from fish selling for their own which enabled them to make small purchases (non-gold ornaments, hair-oil, foods, cloths etc.). Hashemi et al. (1996) suggested women's access to small purchases and savings were useful indicators of empowerment. Dolberg (2003) found an increase in decision making for women involved in small scale poultry and goat rearing on children education expenditure. Several studies have found that women's empowerment, represented by their own income earning ability, household decision-making power, access to resources and education level, has a significant positive effect on both household food security and human capital investment of children (Thomas, 1990; Hoddinott and Haddad, 1995; Quisumbing and Maluccio, 2003). The study found that 10% of the women were involved in deciding expenses for children education. While the other half of the women did not find notable involvement in financial decision making due to their husband's traditional and dominating attitude. Yet, they also felt their status in the household improved through aquaculture activities. Hashemi et al. (1996) notes non-economic dimensions of women's empowerment, which include relative freedom than the past, such as more participation community activities, visiting their natal home, and greater care during sickness etc.

Taking the participation of women in decision making on aquaculture activities and financial aspects, it can be concluded that involvement of women in aquaculture in Mymensingh enhanced their empowerment to some extend.

4.4.3 Farmed fish marketing in Mymensingh and impact on rural livelihoods

Fish marketing in Mymensingh is playing an important role in the rural and peri-urban economy and the distribution of fish both in rural and urban areas simultaneously enhancing aquaculture by creating access to market for fish farmers. Fish marketing process, operations and services have been developed mainly by the private sector. The government has built town markets keeping specific space (10-15% of total of total market) for fish retailing or auction, while in the recent past the government has built some of the rural markets which included specific fish selling space (Bakht, 2000). However, there is no established government regulation and policy on fish marketing. The study focused on the existing farmed fish marketing process and margins, access of farmers of different type of markets and the overall effect on the sector and finally impacts on stakeholders livelihoods.

4.4.3.1 Freshwater farmed fish marketing chain and process in Mymensingh

Fish marketing in Mymensingh was found to be inherently complex due to the existence of different marketing channels and markets, different types of intermediaries, their interactions and contracts (Alam, 2001; Islam et al. 2004b). The marketing chains of farmed fish from sample villages to consumers were relatively short, certainly shorter than the fresh water capture fish marketing chain describes by Muzaffar and Helaluddin (2001). They found that the freshwater capture fish passed through 4-5 marketing intermediaries between fisherman at the fishing grounds and final consumers.

Two factors were attributed to the short chains for farmed fish. Firstly, the majority of farm products in Mymensingh were channelled directly through auction markets to consumers at retail markets passing usually only two intermediaries between farmers and consumers (sometimes 3 levels when fish was channelled from one auction market to another auction market in Dhaka). Secondly, the role of middlemen like *Nikari* was greatly reduced as farmers sold most of their products (85% of total sales)

directly at auction or retail markets. ADB (2005) also found short marketing chain while conducting case studies on pond fish farmers in two villages in Keshorgonj district in Bangladesh as fishes were sold either to nearer town markets or rural retail markets. Farmers direct marketing was influenced by more commercial fish farming. It might also be influenced by NGO initiatives of linking farmers to markets. Many NGOs initiatives encouraged farmers' group members to sell their products directly to the markets (Kar and Datta, 1998; Practical Action, Undated; Zellera et al. 1998).

A few value added activities were carried out in domestic fish marketing such as washing, sorting, auctioning, loading and unloading of fish. However, from farm to consumer, there is no major processing and other than washing mud off, and keeping them wet, carp fishes are sold dead and fresh for domestic consumption. Two reasons can be related to this i) consumers prefer fresh fish rather than processed fish for regular consumption. Although, icing fish is a common practice for maintaining quality, the intermediaries tried to avoid icing fish because when fish was iced it is often considered as “*bashi*” (passed long time after harvest) by the rural consumers. Therefore, the price obtained by selling fresh fish has been higher than selling iced fish. In Malawi Brummett (2000) found that in rural markets, the average price for fresh fish (MK 126.16) was significantly ($P < 0.05$) higher than for preserved forms (MK 59.97 ii) any processing (even icing) increases cost for retailers which ultimately results in lowering profit for retailers (Brummett, 2000). However, fish is iced when transported to other districts or to far retail markets from auction markets, especially during summer.

Alongside dead fresh, live fish were also found to be sold in the same auction and retail markets. Most of the fish sold live are catfishes like (*Pangasius suchii*, *Clarias* sp. *Heteropneustus* sp., etc) and other fish like *Channa* sp. those are alive for a long time in a small amount of water. Selling live fish including carps was a common practice in many south and south-east Asian countries like India (West Bengal), Vietnam, Thailand (Yoonpundh et al. 2002; Tuan et al. 2002). In a study in West

Bengal in India Barman et al. (2004) found that fish is retailed live, which included cultured species (like rohu, catla, tilapia, silver carp, common carp and silver barb) and some wild fishes (cat fishes and snakeheads). They also found that the price of live fish was much higher than that of fresh dead fish (Barman et al. 2004). In another recent study (Ahmed et al. 2005) estimated that carp species comprised about 50% of fish supplied to Gazipur district auction market, while the rest were hilsa 14%, catfish 8%, tilapia 5%, small wild fish 7% and others 14%.

The present study found that selling fish at markets (auction and retailing) was usually not a problem because of two factors i) high demand compare to supply and ii) presence of heterogeneous consumers (FAO, 2001a). The major factors that affect the sale and fish price on a certain day were over or under supply and less customers due to political activities, sudden weather change and major natural disasters.

Farmed fish marketing in Mymensingh was diverse because of its various options of channelling fish from producers to consumers in rural and urban areas. In addition to this, the recently developed direct link with 'Dhaka party' (the auctioneers from Dhaka that buy fish directly from farmers at the farm gate) together with improvement in road communication and telecommunication, especially use of mobile phones has increased the dynamism of whole system. Rapid expansion of mobile communication has improved marketing information flows (Chowdhury, 2006). Direct marketing links with 'Dhaka party' has opened new opportunities for farmers to achieve lucrative prices for their fish and also supported enhanced production.

The majority of stakeholders observed improvement in road communication over the last five years, which had a direct positive effect on marketing by increasingly speed of transactions. The road transport network has been improved in Bangladesh during the last decade that has shortened the transport time (Bakht, 2000). Bangladesh has about 18,738 km of paved roads which connected many rural markets to thana,

district, and important business centres and ports (CPD-BEI, 2001). However, Ahmed et al (2005) notes that there were remote areas which were not well connected to the district markets and fish farmers could not easily accessed town markets to achieve better price.

4.4.3.2 Marketing margins:

The "marketing margin" between consumer and producer prices for agricultural commodities is an important indicator of how effectively markets are supporting the agricultural sector in bringing produce to market (USAID, 2006). The study found that the marketing margins varied for different intermediaries and the share of the consumer's price varied considerably among the stakeholders. Almost two thirds of the price to consumer was obtained by farmers, which can be attributed to i) farmers selling their fish directly at auction markets and ii) the short marketing chain. In a study Alam (2001) found that fish farmers received 56% of consumers' price. Direct marketing also helps farmers to gain higher price for their fish (Jahan and Mustapha, 2001).

Among the intermediaries, retailers received the highest share (13%) of consumer's price at a net profit of Taka 6/kg. But as each retailer traded only small quantities 27kg of fish daily earning Taka 157 were low. Yet, the retailers had to cover most of the risk as fish are a highly perishable product and they are usually sold fresh, even without icing. The risks included deterioration of fish quality due to any transportation delays, sudden weather change (eg. storm) and longer selling time due to fewer buyers. This, consequently led the retailers to sell at a lower price. Similar findings were noted by Chimatiro (1998). He found that sometimes fish retailers in Malawi reduced the price as demand suddenly declined.

The study recorded cost for each activity/person in marketing found that a small proportion of consumer's (4%) price was shared by 5 different levels of support people working in auction markets (cleaner, *Kuli*, water supplier, helper and Koilder).

Their daily income from working in the marketing chain ranged between Taka 60 to Taka 107 clearly indicated that they were the poorest in the marketing chain and society. The incomes of such market support people were similar to the average male labour wage (Taka 75) in Bangladesh (Zug, 2006). The value addition for the services of these people and their share of consumers was ignored in other studies and described as “marketing cost” or “other expenses” (Alam, 2001).

A gradual growth of markets in both rural areas revealed in the study was another remarkable feature that impacted upon farmers’ access to the market. On average one market (including street markets) was found to be established within 10 km of each study village over the last 10 years. Such growth added more dimensions to farmers’ marketing practices as well as fish distribution in rural areas. More importantly, growth of decentralized markets encouraged fish to be retailed in rural areas which in turn supported fish farmers by providing them with easier access to markets and rural consumers. Availability of fish in rural markets at a cheaper price is also critical for poor non-pond people as natural fish is on the decline.

4.4.3.3 Farmers marketing practice

Marketing is one of the most important aspects of sustaining any agricultural production technology (Peabody, 2005). Fish farmers marketing practices in Mymensingh were found to be diverse. Most of the primary requirements of fish farmers were met by the existing marketing systems.

Existence of different type of markets, chains and their opening times provided the farmers with the opportunity to choose suitable selling options according to their products (size, species and quantity) and to sell fish without major problems. This was mainly due to a big gap between supply and demand of fish in domestic markets, which virtually allows farmers to sell any fish regardless of size and species (Muzaffar and Helaluddin, 2001). In addition, a good amount of fish from Mymensingh is exported to other regions of the country.

Overall, the major proportion (69%) of the fish sold from the villages studied was through auction markets. Selling fish directly to auction markets assisted the farmers to obtain higher prices as open bidding in the presence of more buyers in auction markets. Karim (2006) found the major proportion of fish produced villages were sold to markets and the rest was consumed by the farming households. Trondsen (2004) reported that farmers and fishers gain higher prices in auctions compared to any other exchange system. In another study conducted on north Atlantic fish landings Trondsen et al. (2003) found the average price of fish sold under contracts was significantly lower than that by auction.

Although access to different types of market was almost similar for all sample villages, differences were found in farmers' marketing practice between villages. Fish sales were influenced by the level of commercial attitude and intensification. The proportion of fish sold in auction markets was higher in two villages (Damgaon and Ayenakhet), where the farmers adopted a more commercial operation than the other two villages. Karim (2006) also found fish farmers sold fish to auction markets to maximize cash outputs.

Product quality in terms of size and species (high value) including the quantity of fish were the main determinant of selecting markets for farmers for fish sale. In order to obtain higher prices for their fish farmers usually sold their bigger (> 1 kg) and high value (Indian major carps) fish at biggest auction markets in Mymensingh as the demand for bigger and high value fish was comparatively low in the thana or rural auction markets. Similarly when they sold medium fish (between 0.5 kg to 1 kg) they usually sold to thana-level auction markets and the small fishes were sold at rural auction or retail markets.

The adoption of aquaculture has been influenced by the demand for fish, in terms of both species and size. Fish farmers from more commercially operated farms were found more aware about demand and price of fish. ADB (2005) reported many large-

scale farm adopted exotic species like pangus and tilapia for mono-culture for higher yield, while the small-scale farms included silver carp and common carp as major species together with high value Indian major carps in polyculture. Supply of fish in the market follows a seasonal pattern in Bangladesh as well as many other Asian countries (Amilhat et al. 2005). More commercially operated farms in study villages attempted to capture peak market prices by adjusting farm management. For example multiple stocking and harvesting for different species and size of fish as well as seasonality (fish price varies in different seasons) of fish demand and supply. However, typically worse-off farmers with seasonal ponds were less/not able to utilize the opportunities.

Selling fish directly to Dhaka auctioneers was a recent development in fish marketing. During a short supply of fish in Dhaka markets auctioneers contact farmers directly to buy fish from them at the farm gate at a slightly higher price than local auction markets. This also influenced some of the farmers to review their production and product strategy according to the demand of Dhaka party. Demand elasticity of agricultural commodities in most cases determine the level of intensification and adoption of new technologies, particularly if it requires substantial investment (Sunding and Zilberman, 2000). In general, intensification rises with the increase of demand of products (Hossain et al. 2006). However, such demand led adoption in farming systems require improved skill and knowledge. While there are many ways that farmers can receive important technological information (Gupta et al. 1999; Van Everdigen and Wierenga, 2002; Marraa et al. 2003), commercial farmers from the villages evolved gained the required skill for demand led production strategies from increased interactions with markets and channel intermediaries. This ultimately is enhancing the dynamic growth of fish marketing as well as the aquaculture.

4.4.3.4 Generation of employment in fish marketing and impact on livelihoods

The importance of employment for the ever-increasing population in Bangladesh is well established, which was briefly outlined in Chapter 3 (Section 3.4). However, the importance of rural non-farm activities in generating employment and incomes during the process of economic development is also widely recognized. In Bangladesh, rural non-farm now accounts for over 40 percent of rural employment (Hossain, 2004b).

Fish markets have not only played an important role in exchanging products and the distribution of fish in rural and urban areas, but have also generated important livelihood opportunities, particularly for poorer people. Increase of marketing activities in general and perishable commodities in particular are usually a significant labour absorber (Ahmed et al. 2003). Therefore, an increase in agricultural marketing transactions generates substantial rural employments (Lewis et al. 1993; Lewis et al. 1996). On average around 100 people including retailers were found to be involved as self and employer employed basis in auction markets in Mymensingh. The overall number of people employed in fish marketing in Mymensingh had gradually increased; about half of the people working at the time of the study had become involved over the last 10 years. This further confirms the generation of new opportunities, which had accelerated during the last 10 years and was related with an increase of markets and aquaculture production. Hossain (2002) reported that the non-farm rural employments in Bangladesh have increased at about 5% per year since late eighties. However, this growth has occurred from non-crop agricultural sectors, particularly aquaculture and livestock which have experienced substantial increase, while employments in agriculture (crop) has been declined at 1.2 % since the late eighties (Hossain, 2002). Moreover, the growth of fish markets as discussed earlier certainly has further enhanced new employments opportunities in the rural area. On average 19 people (17 retailers, one cleaner and one tax collector) were found to be involved in a single rural retail market in Mymensingh.

The significance of the employment generated in the fish marketing chain in Mymensingh was that the poorer people had access to these opportunities. The average annual household income of this poorer group (*Kuli*, cleaner, water supplier, helper, retailer and *Koilder*) at Taka 48137 was only two thirds of the national average income in 2000 (BBS, 2004). The asset base of these stakeholders also indicated their very poor economic status. Taking this economic comparison in to account the study found that 83% of the people involved fish marketing in Mymensingh, excluding only auctioneers and *sharkers*, were poor. Market cleaners, fish dressers, *Kuli* (labourers) and water suppliers were the poorest of the society. Khatun (2004) also found that marketing intermediaries of aquaculture products, excluding auctioneers and *depo* owners were poor. This confirms that the poor, even the poorest people had access to fish marketing employment. Moreover, the access to this type of employment was wide open. Half of the people involved in fish marketing were from a wide range of different professional backgrounds other than fish marketing. DFID (2006) suggests that markets do not necessarily work in favour of the poor and not all markets opportunities can necessarily be taken advantage of by the poor. Many factors can influence market forces, which mean that they either do no benefit the poor or actively work against them. The poor people must provide access to the opportunity to build and acquire assets (such as income, land, goods and services) and help to reduce vulnerability (DFID, 2006).

The other important attribute of this type of employment is the flexibility of entry and exit, which allowed the stakeholders to diversify their incomes to cope with the seasonal variation of opportunities and incomes. Diversification of livelihoods in rural Bangladesh is critical to reduce income insecurity as well as coping shocks to income sources (Sen and Hulme, 2005). Different income sources found in the study indicated that stakeholders switched to different income activities in different seasons. Fish retailers (9% of total stakeholders) who had a background of fishing in open waters or harvesting fish from ponds often switched between retailing fish in the

market and harvesting fish from ponds in different seasons as opportunities arise. Such diversity of livelihoods has also been found among the retailers who had experience of retailing other agricultural products (10% of total stakeholders). This diversification of livelihoods were necessary and critical to smoothing income for poorer people (Ellis, 2000b).

Employment in fish marketing not only secured their incomes, but also provided them the opportunity to meet different non-income needs. The stakeholders stated several reasons for being involved in fish marketing. One of the important aspects of working with fish marketing was to “get time for other income generating activities”. Many of the markets, particularly rural markets were open half a day (either morning or afternoon) which allowed them to be involved in other income generating activities, mostly agriculture and livestock or fishing as well as operating small village shops. This was found to be important in increasing household incomes as well as developing their asset base. An overview on how increased income improve the asset base and livelihoods is outlined in Chapter 3.

Finally, an important reason for taking up a marketing job was “opportunity for working closer to home” mentioned by many stakeholders. The stakeholders who used to travel or migrate far way for work, found an opportunity to work in fish marketing close to their home and staying with their families attractive. This is, in general, and Bangladesh in particular, a very important advantage as family is the central institution with responsibility for supporting individuals’ needs and social security (Frankenberg and Kuhn, 2004). Searching for secure or better livelihoods drives many migratory movements, and according to Nyberg -Srenson et al. (2002), is the most common where survival is at stake. While mobile livelihoods or livelihoods involving the geographic dispersal of household members can reduce income poverty, migration can also increase social vulnerability. In a study in Chandpur district in Bangladesh Rogaly and Rafique (2003) found that women in households with a single male earner who has migrated rely more heavily than others

on social relations outside their household to keep things going during their husband's absences. This relies on good relationships being maintained with their relatives – the cost here is felt through compromise e.g. giving money at marriages and other important occasions (Rogaly and Rafique, 2003). Marketing stakeholders indicated that staying at a permanent residence with their family improved social relations and networks resulting in higher social security.

4.4.3.5 Livelihood impacts of marketing employment on stakeholders

The study revealed that livelihoods of the majority of stakeholders (85%) had improved over the previous five years. Employment in fish marketing contributed the most in improving livelihood outcomes. The majority of stakeholders maintained pluriactivities and at least 2-3 income sources, which is a common phenomenon in Bangladesh and other developing countries in Asia (Ellis 2000b; Devereux 2001; Webb et al. 2002). However, income from marketing comprised almost three quarter of the total household income.

In general the basic living requirements had improved for the majority of stakeholders over the previous five years. However, a remarkably higher proportion of poorer stakeholders stated that their food and clothing was improved over the previous five years compared to richer stakeholders. This is a common a phenomenon as food consumption of low-income households is significantly co-related with income (Webb et al. 2002). Increase in income for the poor NGO beneficiaries from different regions of Bangladesh significantly increased consumption of several food items (Alam, 1997a). While (Nielsen et al. 2003) found that increased income from commercial poultry production reduced food starvation in the lean season (about 4 month per year) for 75% of the NGO beneficiaries. However, on the other hand the increase of income did not affect food consumption and clothing for auctioneers, rather they gained through improvements in health, education and savings.

Natural capital which made up with land, water and environment and physical capital (basic infrastructure, production equipments and inputs etc.) are critical to the rural poor, mainly because of their poor human capital. Improved accesses to those resources, which enable them to secure livelihoods, are essential elements of strategies to reduce poverty (Rakodi, 1999). This has implications both for rural poor people engaged in both farming and non-farm activities. The study found that earning from fish marketing enabled stakeholders to invest in the household's asset portfolio. The stakeholders were found to buy homestead land, buy or lease in agriculture land, livestock as well as invest in a small shop. Some others leased-in ponds and become involved in aquaculture. Rakodi (1999) suggested often the management of assets and activities pursued is opportunistic or reactive as most vulnerable individuals and households adjust unpredictable circumstances, rather than strategies planned in advance. Nevertheless, poor people may be seen as managers of complex portfolios in which assets are inter-related (Moser, 1998). The study revealed that the access to different assets for stakeholders was complementary to overall livelihoods as those were supplemented to improve their livelihoods.

The other important outcome was the improvement of social status and networks which was important to achieve individual and social objectives. However, as a relation concept, social status can not be measured in its own right and assessment relies on proxy indicators (Booth et al. 1998). In practical terms, this includes the perception of trust, unity and a spirit of participation, associational activities and association with external groups (Rakodi, 1999). The present study found that the stakeholders' individual social status and networks were enhanced through establishing relations by successfully organizing marriage of daughter or sister, exchanging gifts, organizing social gathering at different occasions, repayment of loan as well supporting others during crisis. These social variables are powerful determinants of sustainable rural livelihoods (Narayan, 1997). The social networks were also important to access "political capital", which is best described as

“gatekeeper assets”, permitting or preventing accumulation or sustaining other assets upon which successful livelihoods depends (Booth et al. 1998). The poorer stakeholders were found to use the social relations for coping short term risk and crisis by borrowing money or credit. However, in general all these established that a wide range of livelihood needs of stakeholders was met during the last 5 years through the employment with fish marketing.

In contrast, some stakeholders (15%) were found to remain vulnerable as their livelihoods either did not improve or even deteriorated. Several factors caused such livelihood deterioration, of which ill health was found the most common for poorer stakeholders. While poverty, which implies a lack of resources deemed necessary for survival, can be associated with poor health, particularly in less developed countries (McCally et al. 1998), the cost of healthcare itself can be a cause of poverty in low-income households through loss of income, astronomical health expenditures, and potentially irreversible crisis coping mechanisms that involve asset and savings depletion (Ahmed 2006). There is a strong co-relation between income and health condition (Martikainen et al. 2003).

The other vulnerability aspect for the marketing stakeholders revealed in the study was the marriage of a daughter or sister. Although organizing marriage was found to improve social status, some the stakeholders found that the expenditure, especially dowry, as a major shock with which it was difficult to cope using available resources. Dowry is the transfer of cash and/or kind by the bride’s family to the bridegroom’s family during marriage (Esteve-Volart, 2003). Although transferring dowry is illegal by “ The Dowry Prohibition Act of 1980”, it is practiced by more than 75% of families in Bangladesh regardless of religion (Saleh, 2004). Dowry is identified as one of the important causes of poverty among rural people. Webb et al. (2002) notes that a family having a daughter nearing marriageable age and hence soon needing a dowry was sufficient cause to rank their household as more insecure today than they had been a year earlier. Sen (2004) found a decline in natural and financial assets of

poorer households caused by dowry. In spite of these major factors for deterioration of livelihoods, a minor proportion of stakeholders identified increase in expenses for increased family size and childrens' education as causes of livelihood remain similar.

Despite, the above vulnerability aspect, employment in fish marketing through development of aquaculture, as a whole, generated employment in the marketing in both rural and urban areas in Bangladesh, where labour supply is still abundant and the employment impacts has been very important to poverty reduction by improving livelihoods. Importantly the employment brought many livelihood welfare to the stakeholders. In many developed countries, industrial aquaculture has given emphasis on labour-replacing technologies as production and processing systems intensify (Ahmed 2002). Therefore, in order to sustain the benefits of employment for the poor, future aquaculture development policies should provide increased institutional and infrastructure support for diversification of production, product and trade, and development of backward (input supplies) and forward linkages (post-harvest and value-added activities) for resource-poor households.

CHAPTER 5 Impacts of rice-fish farming and marketing of aquaculture products on rural livelihoods

5.1 Introduction

Traditionally Bangladeshi rural people capture wild fish that enter the rice fields during and after the monsoon in low-lying areas. Integration of fish by deliberate stocking fish seed in rice fields was introduced and promoted during the 1980-90s by the research and development agencies. Since then the technology has steadily spread in different parts of the country (DoF, 2002; Gupta et al. 2002). Being the most important rice growing area in the country, the northwest region has some of the greatest potential in Bangladesh for promoting this integrated farming system.

To utilize the potential and to promote integrated rice-fish farming government and donor agencies, DFID and CARE together with local and national NGOs implemented several research and development projects during 1990s (Meyer, 1997; Gupta et al. 1992). As a result of the promotion initiatives, the technology was steadily taken up and practiced by rice farmers in many parts of the region in which Dinajpur district is notable. The farmers grow fish both in irrigated *boro* and rain fed *amon* rice. In *boro* season farmers mainly grow fish fingerlings, while in the *amon* rice they grow table fish by stocking fingerling. Rice-fish systems are mostly considered to have incremental benefit with a low marginal investment cost (ADB, 2005). Although the fish production level is low compared to pond fish production (184 kg/ha in irrigated rice and 233 kg/ha in rain fed rice) (Gupta et al., 2002), the contribution of rice-fish to household nutrition and income benefits have been found to be significant, especially for poorer rice farmers with no pond resource (Barman, 2000; Gupta et al. 2002; Barman and Little, 2006).

However, documentation of the effect and benefits of agricultural growth of new technologies is often restricted to the producer household, rather they may spread to the wider community. The impacts of rice-fish farming to the wider rural livelihoods are yet to be fully understood. The impact of fish supplied from rice-fish system as well as other aquaculture systems on the local demand and markets and marketing which includes farmers access to market are mostly unclear. This chapter aims to explore the broader impacts aquaculture with a focus on adoption of rice-fish system on rural livelihoods and tests the broader hypothesis that aquaculture production and marketing have significantly enhanced rural livelihoods in Dinajpur.

5.2 Methodology

This section of the chapter describes the research process and data collection methods and tools used to achieve the aim of the chapter and to test working hypotheses stated in 1.4.1 in Chapter 1.

5.2.1 Data collection aquaculture production at village level in Dinajpur

5.2.1.1 Selection of rice-fish farming villages and rice-fish farmers

According to the research strategy the research process in Dinajpur site was started with identifying sample representative villages in which rice-fish farming was established. As mentioned in Chapter 2 the sample villages were selected from the phase-out villages of GO-INTERFISH Project, the research collaborator in Dinajpur and the selection process was carried out jointly with GO-INTERFISH. The project had 23 phase-out rice-fish farming villages at the time the study was processed and the study villages were sampled from those 23 villages. Details of the general procedure and the approach of sampling villages have been described in Chapter 2. However, the process, sample size and data specific for Dinajpur district are outlined below in 3 steps;

Step 1: List of GO-INTERFISH phase-out rice-fish farming villages was collected from the office.

Step 2: All villages were surveyed with short structured questionnaire with KIs to develop the overall understanding of rice-fish farming villages. GO-INTERFISH Project staff working in particular phase-out villages were asked to fill the questionnaire in consultation with KI (KIs were selected by project staff from their experience) from each village. The villages were then sorted by occupational, economic, and key fish marketing practices purposively for the study (described in Chapter 2). The results of the survey are outlined below:

i) Occupational status:

Agriculture has been the main the livelihood strategy for the most of the resident families in GO-INTERFISH phase-out rice-fish farming villages. However, the number of practicing rice-fish farmers averaged 11.6, but varied widely among the villages ranging from 3-26 per community (Table 5.1). The number of rice-fish farmers were considered the first criterion of sampling study villages. Therefore, villages with ≥ 15 rice-fish farmers were selected and considered for the next round sorting. The criterion (≥ 15 rice-fish farmers) was fixed ensuring villages with a higher number of rice-fish farmers was considered further. Out of 23 villages 11 were identified where the number of rice-fish farmers ≥ 15 .

Table 5.1: Status of the occupants of CARE phase-out communities in Dinajpur

Number of rice-fish farmers in villages (Mean)	Economic status (average)			Farmers' fish selling practice	
	Worse-off (% mean)	Middle (% mean)	Better-off (% mean)	Auction market (% amount)	Retail market (% amount)
11.6 (± 8.4)	34.8 (± 7.69)	51.9 (± 5.1)	13.3 (± 6.8)	53.0 (± 26.8)	47.1 (± 26.3)

ii) Economic status: The overall economic status of the resident families in the villagers was considered as a second criterion for identifying target villages. Households in each village were divided proportionately (%) into three comparative economic classes i) Worse-off (poor living conditions like poor food, clothing, housing ii) Middle class (living conditions between worse-off and better-off) and iii) Better-off (better living conditions) by Go-INTERFISH field staff in consultation with village key informant (either Union Council member or school teacher) using their perception and observation about each village. The result showed that the average proportion of worse-off households was 35%, middle class 52% and better-off was 13% (Table 5.1), but varied widely among the villages. The proportion of worse-off households ranged from 20%-50% among the villages. Therefore, the villages consist

of $\geq 35\%$ worse-off households were selected for further consideration. The criterion ($\geq 35\%$) worse-off households village was used to further select villages with a higher proportion of worse-off people involved in rice-fish production. Eight villages out of 11 villages (from first sorting) were found where $\geq 35\%$ households were worse-off and were taken for further consideration for selection.

iii) Farmers fish marketing practice: Farmers marketing practice is considered as the third and final criterion of sampling study villages. Most farmers sold their fish at auction market and/or retail market. However, the survey result showed that there were variation among villages regarding farmers' selling fish at auction and retail markets. In some villages most of the farmers sold their fish at auction markets, while in the other villages farmers sold at retail markets. To ensure both type of farmer practice in the study, villages (from 2nd sorting) were divided into two groups as: a) villages with $\geq 60\%$ fish sold to auction market and b) villages with $< 60\%$ fish sold fish at auction markets. There were 5 villages found in group a) and 3 villages in group b). Finally two villages were sampled randomly from each group totalling 4 villages for Dinajpur site. The sampled villages were Telipara, Volanathpur, Sharderpara and Gongapur (Figure 5.2). A flow chart of the whole process is shown in Figure 5.1.

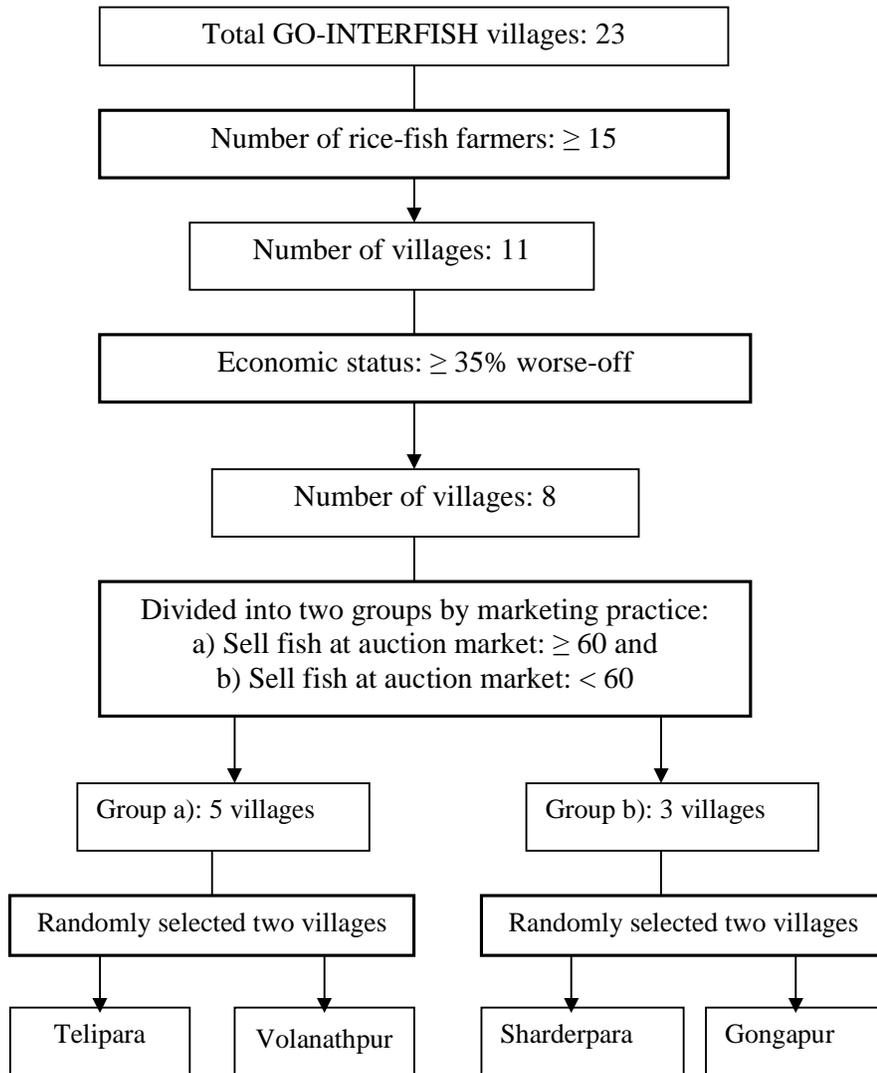


Figure 5.1: Flow chart of village selection in Dinajpur site

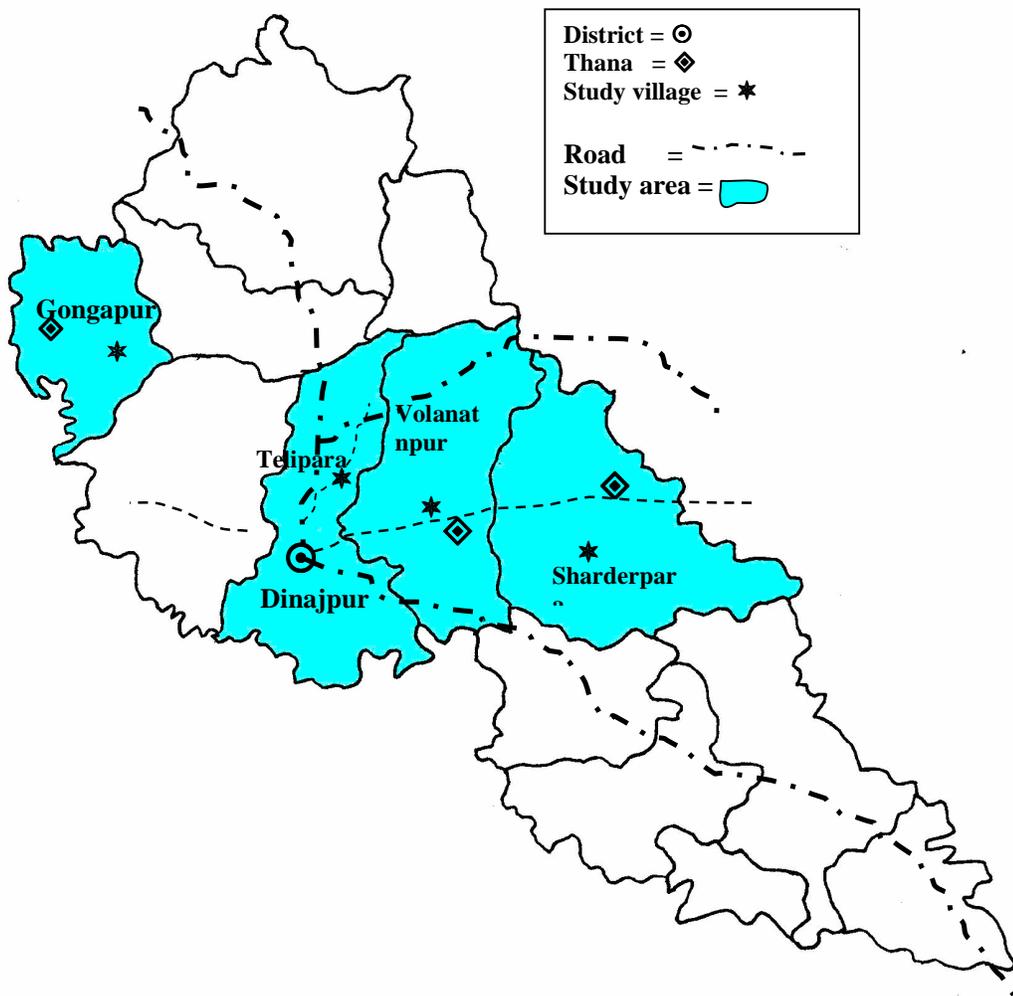


Figure 5.2: Map of Dinajpur showing sample villages

The number interviews and focus group discussions (FGDs) used is outlined below in Table 5.2.

Table 5.2: Number of samples/participants in different data collection tools

Survey tools	Number of samples/participants
Interview of pond fish farmers (Baseline and monitoring)	48 (total)
FGDs with fish farmers (in each village)	65
FGDs with fishers (harvesting team)	63
Tracking marketing chain (from farm to consumers)	3 times from 2 villages
Observation of marketing activities	4 auction markets and 6 retail markets
Individual interview with marketing intermediaries (semi-structure questionnaire)	149 people (from above 4 auction and retail markets)
Individual interview with women from fish farming households	134 women from 4 sample villages

The questionnaire used in interviewed were validated before data collection through a process described at 2.3.15 in Chapter 2. The procedure followed for data processing and analysing have also described in Chapter 2.

5.3 Results

This section of the chapter contains the results obtained by analysing the data collection through the research process and methods describe in section 5.2 in this Chapter.

In FGDs with farmers in Dinajpur it was established that some farmers had both a rice-fish plot and a pond. In those cases certain activities were carried out together for rice-fish plots and pond, such as feed preparation and feeding, hired labourers carried out both rice-fish and pond works, hired fishers harvested from both rice-fish and pond etc. Moreover, some rice-fish plots were connected with ponds, rather than small ditches. Therefore, the study combined both rice-fish and pond fish systems and assessed the impact of aquaculture in Dinajpur site. As such the results presented in this chapter in many cases combines rice-fish and pond fish farming and is referred to as ‘aquaculture’.

5.3.1 Livelihood impact in production level

5.3.1.1 Livelihood impacts on rice-fish farmers

The livelihood assets profile of rice-fish farmers in Dinajpur obtained through the questionnaire survey is shown in two categories in Table 5.3. The main difference between better-off and worse-off farmers was in the natural and human capital base. The arable land size of better-off farmers was significantly higher ($p < 0.05$) than that of worse-off farmers.

Table 5.3: Livelihood assets for rice-fish farmers by well-being

Assets	Worse-off Mean \pm Stdev (% farmers)	Better-off Mean \pm Stdev. (% farmers)
Family size	6.19 \pm 1.8	6.5 \pm 2.4
Household head age (years)	41.5 \pm 10.6	45.4 \pm 13.1
Household head (5-12 class) %	37%	53%
Homestead land (ha)	0.04 \pm 0.02	0.10 \pm 0.04
Arable land (ha)	0.61 \pm 0.37	2.95 \pm 1.3
Rice-fish plot land (ha)	0.18 \pm 0.80	0.31 \pm 0.15
Rice-fish ditch size (square m)	4.8 \pm 4.5	5.3 \pm 4.5
Pond size (ha)	0.06 \pm 0.03 (72%)	0.2 \pm 0.08 (83%)
Cattle (number)	2.94 \pm 3.0 (77%)	5.17 \pm 4.3 (86%)
Goat (number)	2.12 \pm 1.70 (58%)	2.43 \pm 2.90 (62%)
Poultry (Chicken & duck) number	19.34 \pm 8.6 (100%)	24.45 \pm 7.13 (100%)

Production practices of rice-fish farmers



Figure 5.3: Partial view of a rice-fish farming plot

5.3.1.1.1 Rice-fish production cycle

The new season starts with *boro* rice-field preparation in the month of January. Dikes and rice-fish ditch (refuge for fish) were repaired as usually they become damaged and fragile due to the previous years heavy rain or flood. All the farmers spread organic fertilizer in the rice-field before ploughing. Many farmers applied quick lime at about 100-150 kg/ha in the rice field and ditch. Then the rice fields were irrigated and ploughed, and rice seedling transplant immediately after ploughing. All the farmers used high yielding rice varieties.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Boro</i> rice-fish												
Plot preparation	■											■
Rice transplanting		■										
Rice harvesting					■	■						
Fish stocking		■	■									
Fish harvesting					■	■	■					
<i>Amon</i> rice-fish												
Rice transplanting							■	■				
Rice harvesting											■	■
Fish stocking							■	■				
Fish harvesting											■	■

Figure 5.4: A more common main activity calendar for integrated rice-fish farming

In *boro* rice field farmers produced fish fingerlings. After 2-3 weeks of transplanting rice seedling farmers raised the water level and stocked tilapia brood fish or common carp spawn in the ditch. The stocking rate of tilapia brood is usually about 1:2 male-female ratio. Maintaining water level irrigation, supplementary feeding and removing weeds from the rice fields were the main management task for the rice-fish system until harvest. Most of the farmers started selling fish fingerling after 45-60 days of stocking by regular partial harvest. Most of the farmers harvest their rice in mid June.

In *amon* rice fields farmers grew fish for consumption and sale. After 2-3 weeks of transplanting rice seedling farmers stocked fish fingerlings of different species, but commonly shorputi (*Barbades gonionotus*) and common carp (*Cyprinus carpio*) as main species with Indian major carps. Stocking densities varied widely with the level

of water and the ditch size. This was usually between 2000-8500/ha. Farmers harvested fish for home consumption and sold the remaining fish at the end of the rice season during November to December.

Household income

Monthly monitoring was done with 48 rice-fish farming households in two categories (worse-off and better-off) from four sample villages in Dinajpur for 12 months on income amount and sources. The mean annual income for rice-fish farmers under two categories household collected through monthly monitoring is shown in Table 5.4.

Table 5.4: Mean annual household income (Taka) for rice-fish farmers

Sample villages							
Telipara		Sharderpara		Volanathpur		Gongapur	
Worse-off	Better-off	Worse-off	Better-off	Worse-off	Better-off	Worse-off	Better-off
47977 (774)	130810 (2110)	49745 (802)	109857 (1772)	49488 (798)	89233 (1439)	46363 (748)	95016 (1533)

(USD, 1 USD = Taka 62)

The overall mean annual income from worse-off farmers (Taka 48,293 ±16815) was much less ($p < 0.05$) than that of better-off farmers (Taka 105366 ±30509). Mean income from rice Taka 28761 (37% of total income) was the highest component of income and much higher ($p < 0.001$) than other sources (Figure 5.5). However, income proportion from fish to total household income for worse-off farmers was (19%) slightly higher than that of better-off farmers.

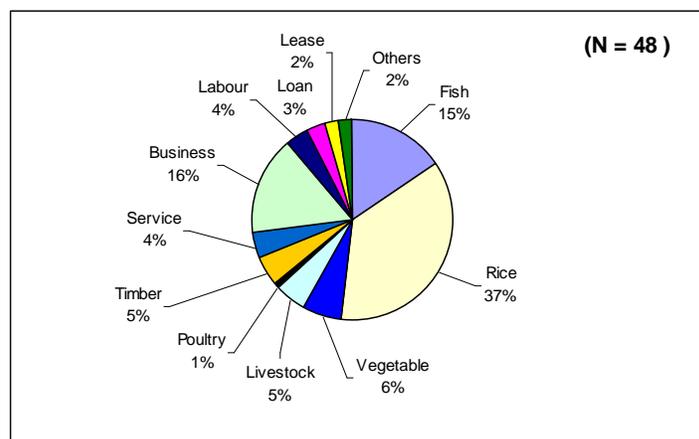


Figure 5.5: Proportion of annual household income of rice-fish farmers

5.3.1.2 Impact of aquaculture on household food consumption

Monthly monitoring of food consumption showed that the major proportion of the main food types (rice, fish and vegetables) consumed by the farming households was sourced from their own farm (Figure 5.6). The annual per capita fish consumption of aquaculture farmers was 11.2 kg and there were no significant difference between worse-off and better-off farmers.

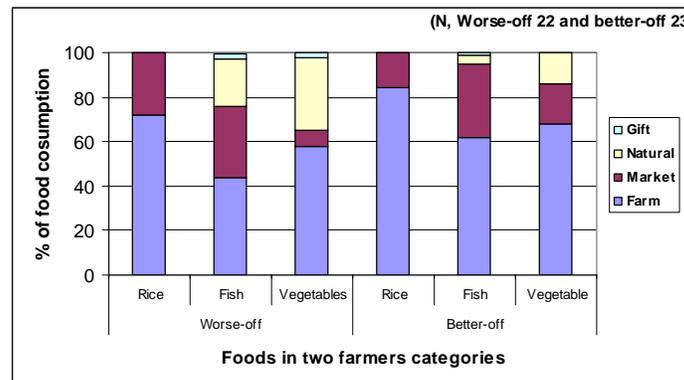


Figure 5.6: Source of food consumed by rice-fish farming households

The rice-fish farmers were qualitatively assessed regarding the trend of their overall livelihoods and the result shows that livelihoods of the majority of rice-fish farming households (81%) had improved (better condition of basic needs; food, shelter, clothing, health and education) over the previous five years. The proportion of worse-off and better-off farmers in improving livelihoods did not differ across the study villages.

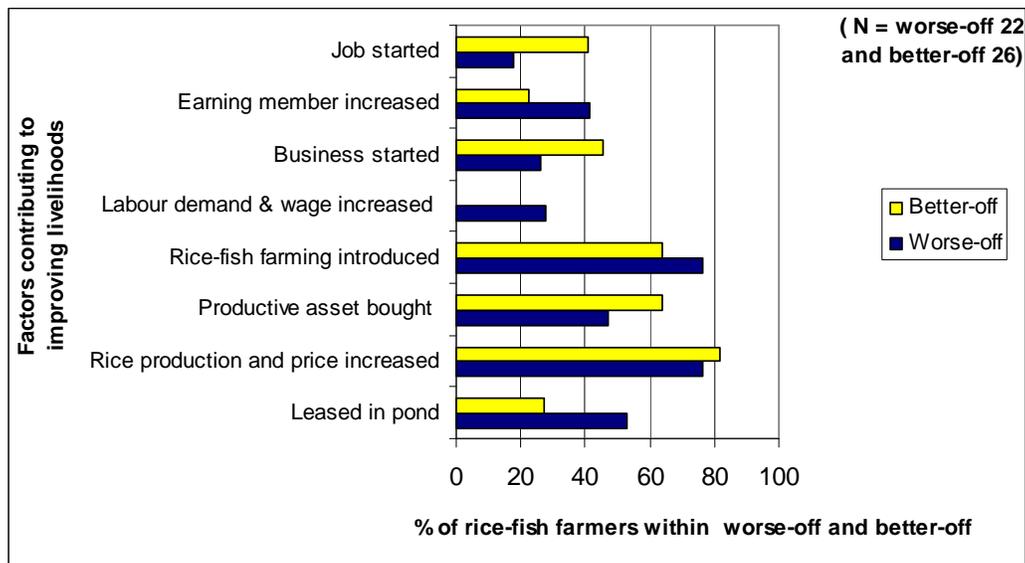


Figure 5.7: Factors contributing to improving livelihoods of farmers

Several factors contributed to improving livelihoods of rice-fish farmers, which are categorised and presented for worse-off and better-off farmers in Figure 5.7. Increases of rice production and increased price of rice” and “introducing rice-fish production” into farming systems were found as the most important factors in improving income (Figure 5.7). Increases in agricultural labour demand and wage rate helped in improving the livelihoods for a 26% worse-off farmers.

Farmers mentioned improvement of multiple outcomes to refer livelihood improvement. The outcomes are categorised and presented in (Figure 5.8). Improvement in food consumption (84% farmers) and clothing (76%) was the most important livelihood outcomes for worse-off farmers over the previous five years. While the better-off farmers emphasised improvement of housing (73%), health (68%), sanitation (64%) and increase of productive asset were the main outcomes over the previous five years. Improvement of productive assets was also found important in improving livelihoods.

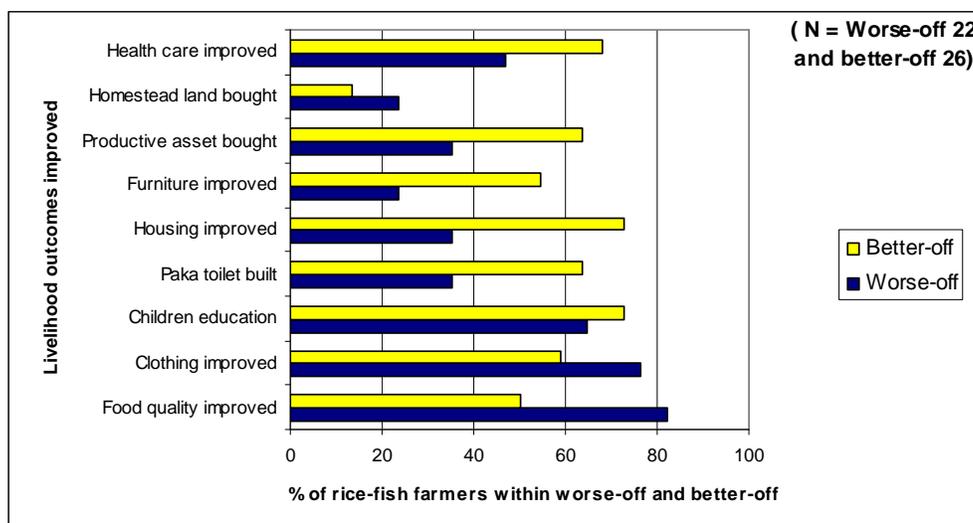


Figure 5.8: Livelihood outcomes (indicators) for rice-fish farmers

5.3.1.3 Livelihood impacts on aquaculture labourers

The results of 4 FGDs with wage labourers involved in aquaculture at Dinajpur site are shown in Table 5.5 and described below;

Table 5.5: Impacts of aquaculture wage labourers in Dinajpur

Aspects	Telipara	Volanathpur	Sharderpara	Gongapur	Mean (village)
Total agricultural labour	30	100	35	30	48.8
Number of aquaculture labourers	11	25	10	8	13.5
Aquaculture work 10 year ago (days/week)	Occasional	1	Occasional	Occasional	
Current aquaculture work during survey	1.5	2.0	1.5	1.0	1.5
Mean daily wage 10 year ago (Taka)	55	55	55	45	53
Current mean daily wage (Taka)	65	65	70	65	66
Food consumption improved (% of labourers)	90	85	85	80	85
Clothing improved (% of labourers)	75	75	70	65	70
Housing improved (% of labourers)	65	60	60	55	60

Employment for aquaculture labourers was increased steadily since 1999. Twenty seven percent of the total agricultural labourers were involved part-time in serving

aquaculture. On average labourers worked 1.5 days per week at the time of survey. Before the introduction of rice-fish) they had less opportunity to work (1-2 days/month) (Table 5.5). The rest of the days labourers did other agriculture activities. Aquaculture labourers in Dinajpur informed that crop diversity, particularly rice, and intensification influenced the labour demand and wage. The real labour wage had also increased significantly from Tk. 53 (weighted with inflation) to Tk.66 at the same time. There was no difference among the villages for labour wage. In Dinajpur a meal (lunch) was provided with cash as part of the contract.

Fish farmers also gave a small cheap fish (200-300g) to labourers after any fish harvest. On average labourers received fish from farmers 2-3 days/month, which comprised 9% of the fish consumed (weight) by the labourer’s households (Figure 5.9). It was established that food consumption had improved on average for 85% labourer’s households during the last 10 years, while clothing and housing had improved for 71% and 60% labourers respectively during the same period.

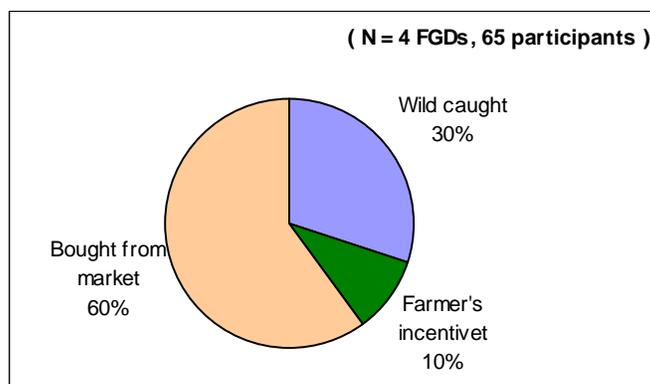


Figure 5.9: Source of fish consumed by aquaculture labourer’s households in Dinajpur

5.3.1.4 Livelihood impact on fishers

The harvesting team (professional fisher) were also directly involved in aquaculture for harvesting fish from ponds and rice-fields. The results of four FGDs are presented in Table 5.6. In the FGDs fishers explained that they usually harvest fish from both

the ditches attached to rice-fish plots and ponds if required. So, the numbers presented in this chapter for fishers were combined with both rice-fish and pond fish production. The number of fishers involved in harvesting fish in the sample villages was averaged 32 (± 20.3) and ranged between 12 and 60 (Table 5.6).

Table 5.6: Livelihood impacts of small-scale aquaculture on fishers in Dinajpur

Events	Telipara	Volanathpur	Sharderpara	Gongapur	Average
Total fisher in the village	12	30	60	25	32
Total harvesting (pond and wild fish) (days/week)	5	6	5	5	5.25
Aquaculture harvesting during survey (days/week)	4	5	3	3	3.75
Aquaculture harvesting 10 years ago (days/week)	1	2	1	1	1.25
Food consumption improved (% of fishers)	85	90	85	80	86.25
Clothing improved (% of fishers)	70	75	70	75	72.25
Housing improved (% of fishers)	65	65	70	65	66.25

The number of harvesting days per week averaged 3.75 days/week which had been increased from about 1 day per week over the last 10 years. The mean harvesting days/week did not vary among the villages (Table 5.6). The fishers' daily earnings had increased from Taka 58 (weighed with inflation) to Taka 74 over the previous 10 years (Figure 5.10). Results of FGDs with fishers indicated that on average food consumption increased for 85% of the fishers, while clothing and housing had improved for 72% and 66% of fishers respectively.

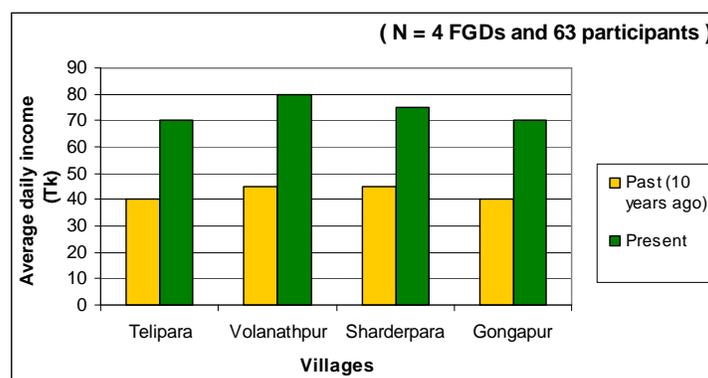


Figure 5.10: Daily income for fishers in Dinajpur during the study

5.3.2 Role of women in aquaculture farming and impacts

5.3.2.1 Role of women in aquaculture in Dinajpur

The majority of the women from fish farming households were found to be perform three integrated fish farming activities (Table 5.7). On average 86% of the women were involved in fish feed preparation, feeding (82%) and in growing vegetables (78%) on the pond and/or rice-fish dikes. There was no notable difference in the proportion of women performing these three activities between the villages in Dinajpur. A small proportion of women were also involved in harvesting fish (8%) and reconstruction of pond or rice-field dikes.

Table 5.7: Aquaculture activities carried out by women in Dinajpur

Aquaculture management activities	% of women involved in aquaculture activities in different villages			
	Telipara (n=32)	Sharderpara (n=29)	Volanathpur (n=30)	Gongapur (n=33)
Feed preparation	88	79	87	91
Feeding to fish	78	76	80	88
Vegetable growing	84	79	73	76
Preparing pond dike	13	14	13	3
Pull net for harvesting	9	7	13	3

5.3.2.2 Time spend on agricultural activities and workload

On average the women in Dinajpur spent 30 (\pm 15) minutes daily for fish farming activities of which was 15% of total time spent (178 ± 74 minutes) for agricultural activities (Figure 5.11). The women spent highest proportion (49%) of their time for livestock rearing.

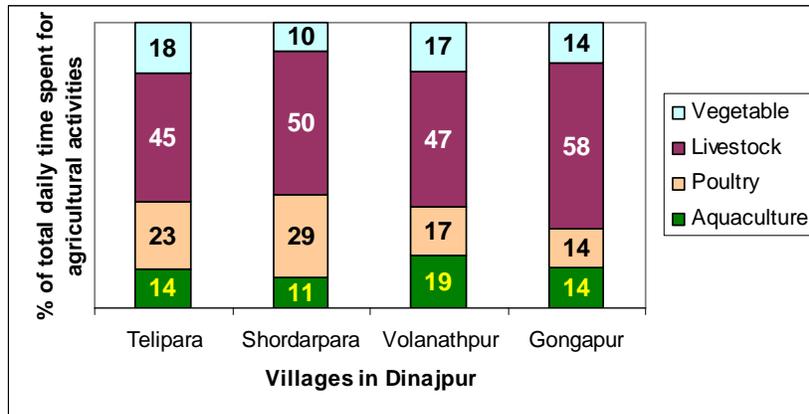


Figure 5.11: Time spent for different agricultural activities by women in four villages in Dinajpur

5.3.2.3 Involvement of women in decision making process:

The study found that 62% of the women involved in aquaculture were consulted by their husbands for different fish farming activities and the rest (38%) did not feel that they had any active role in decision making. The subject matters discussed by their husband are categorized and shown in Figure 5.12. The majority of the women discussed feeding (72%) and stocking of fish (68%), followed by harvesting (43%).

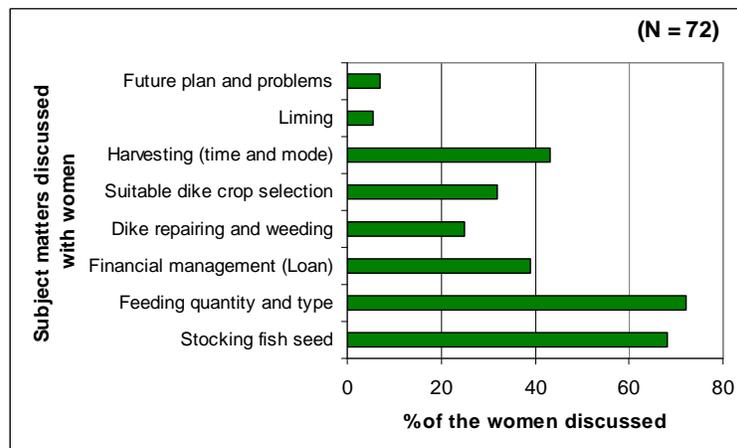


Figure 5.12: Subject matters discussed with women by their husband (Dinajpur)

5.3.2.4 Financial control:

Women involved in fish farming activities were asked whether or not they were involved in financial decision making of the household. The results shown in Figure

5.13 indicated that 47% women mentioned they were involved in financial decision making. Yet, the rest 53% realised that they did not have notable involvement in financial decision making. Women from 19 % households were given some money to spend independently.

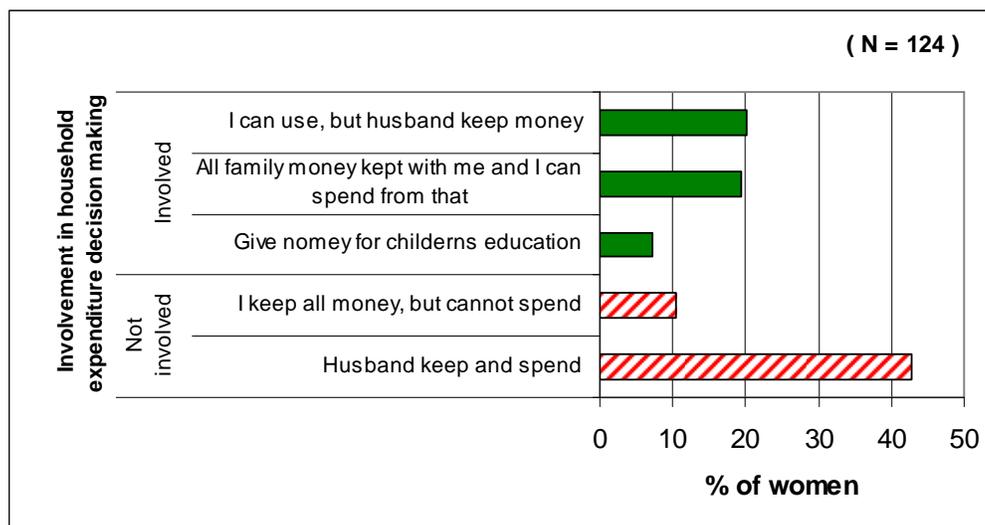


Figure 5.13: Involvement in financial decision making

5.3.3 Fish marketing and employments

5.3.3.1 Farmed fish marketing chain in Dinajpur

Farmed fish marketing chains in Dinajpur were identified by tracking fish from the farm gate (at two sample villages at two thanas in Dinajpur) to consumers purchasing at retail markets. Although farmers sold their fish at different markets, the marketing chain was found to be same in terms of the level of intermediaries. Combining the fish marketing chain identified in that process with other fish selling options for farmers' is shown in Figure 5.14.

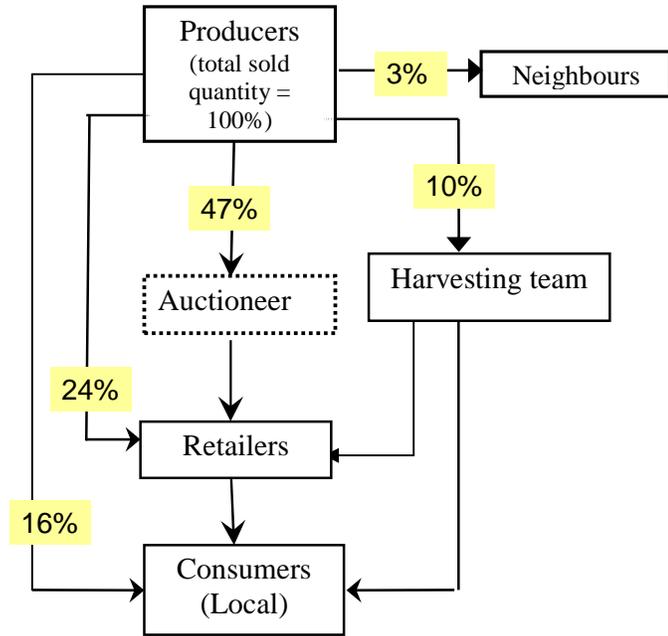


Figure 5.14: Farmed fish marketing chain in Dinajpur

Fish produced in Dinajpur district were marketed and consumed locally. Fish farmers used different options to sell their fish. In most cases the farmers sold fish directly to auction markets (wholesale markets). In auction markets, retailers buy the fish through bidding. Fish were then transported to other retail markets. Thus most of the farmed fish from the sample villages in Dinajpur were channelled from farmers to consumers through two levels of intermediaries (auctioneers and retailers). In some cases farmers sold their fish to retail markets either to consumers or to professional retailers, and retailer then sold fish to consumers. Farmers also sold at farm gate to harvesting team or sometimes professional retailers (make initial contact in advance).

5.3.3.2 Fish marketing activities, processes, people involved and their role

After harvesting, fishes were washed with water and then transported to market. Carps were sold dead. Most of the cases farmers hired vans to transport fish. However, in few cases they carried fish by bicycle to markets. While the farmer could sell fish through any auctioneer, farmers usually sold fish through one particular auctioneer due to a good relationship. However, farmers taking credit from any auctioneer had to

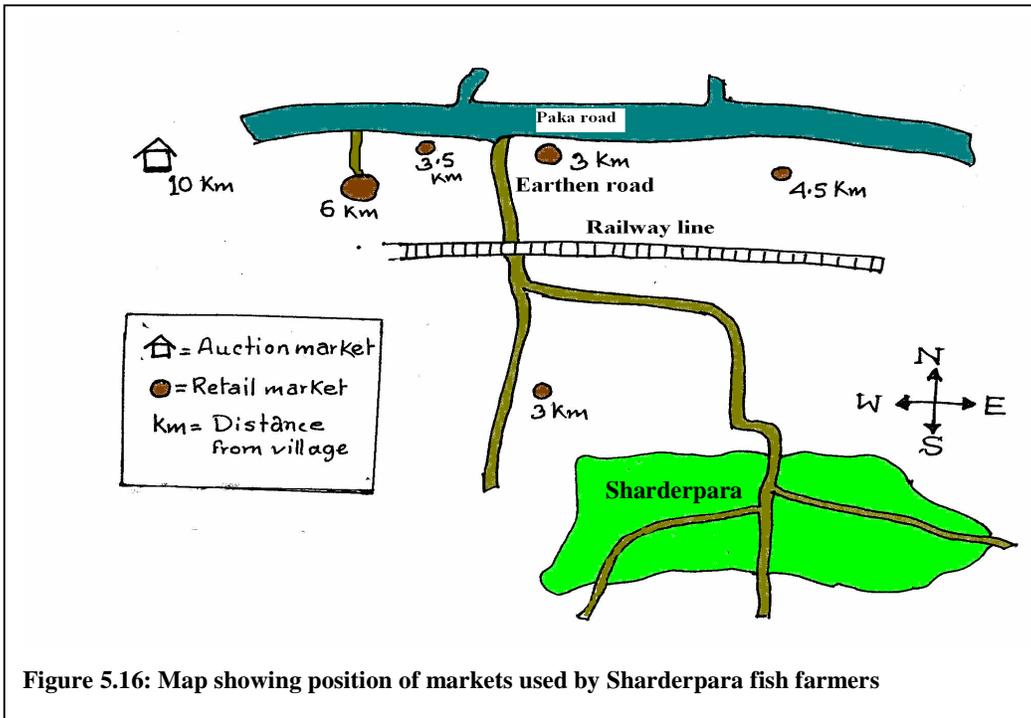
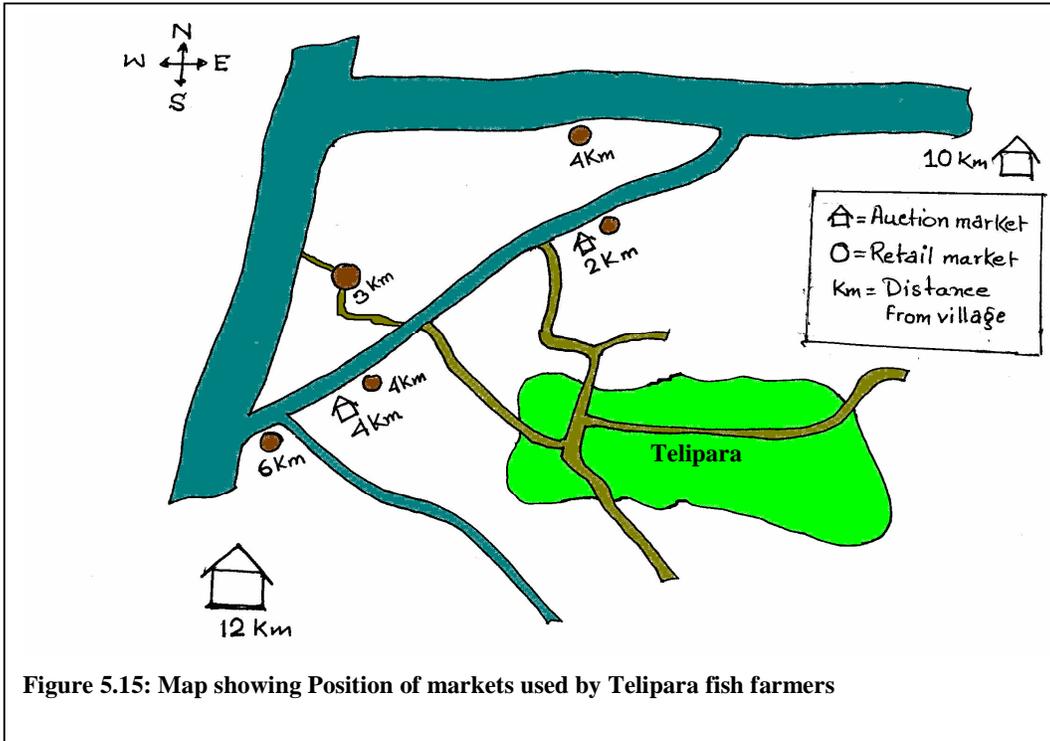
sell his fish to that particular auctioneer. A few value adding activities were carried out in auction markets and during the transaction including washing fish to remove mud, sorting and grading according to species and size by eye estimation, weighing fish, loading and unloading. Retailers took the fishes on credit after the auction process and transported different retail markets. Farmers were usually paid within 2-3 hours. Usually farmer paid for i) auctioneers 3% of total auction price, ii) market tax (Taka 3-5), iii) cleaner one small fish of Taka 4-5 or money (who sell big fish), iv) *Kuli* Tk. 3-5 (unloading labour), water supplier Taka 2-3. On the other hand, auctioneers paid his employees like manager (*sharker*) and assistant on a monthly or weekly basis. Most of the auction markets were operated in the morning, but some rural were auction markets operated in afternoon.

5.3.3.3 Farmers marketing practice in Dinajpur

Farmers had five different options to sell their products. Farmers used different type of markets at different times. Distance and cost of transport is shown in Table 5.8 and their position is shown in (Figure 5.15) and (Figure 5.16). There was no major difference between the villages regarding accessing markets (distance) and transport cost.

Table 5.8: Fish markets used by farmers from sample villages

Villages	Auction markets				Retail markets		
	Village distance from <i>paka</i> road	Number	Average distance (km)	Average transport cost (Taka)	Number	Average distance (km)	Average transport cost (Taka)
Telipara	2	4	6.9	18	5	3.7	6.8
Volanathpur	2	2	10	25	5	2.5	6.2
Sharderpara	3	1	8	15	4	4.8	9
Gongapur	1.5	2	11.5	27	4	4.75	9
Average	1.9	2.3	8.9	21	4.5	3.9	8



However, there were some remarkable differences in farmers' practice in using different options between the villages. The proportion of fish sold through different options for sample villages is shown in (Table 5.9). Two of the four sample villages (Telipara and Sharderpara) are located close to auction markets (3 and 6 km respectively), but farmers from Telipara sold mainly auction markets (70% their total sale to), while Sharderpara farmers sold mainly at retail markets (69% of their total sale). On the other hand, farmers from Volanathpur (average distance from auction market 10 km) sold 76% of their fish to auction market, while in Gongapur (average distance 11.5 km) farmers retailed 58% of their fish directly to consumers at retail markets. In general, the proportion of fish sold at the farm gate to fishers and neighbour was similar for all villages (Table 5.9).

Table 5.9: Farmer's fish selling practice (% of total fish sell) in Dinajpur

Category of villages	Village name	Selling at market			Selling at farm gate	
		Auction market	Retail market	Whole sell to retailers	Retail to consumers	Neighbour
Villages closer to auction markets	Telipara	70	15	3	2	10
	Sharderpara	25	60	2	3	10
Villages farer to auction markets	Volanathpur	75	10	3	2	10
	Gongapur	20	10	55	5	10
Overall	Average	47	24	16	3	10

Usually farmers collected market price of fish from other farmers. There was no formal system found from where farmers could access price and demand information. Farmers reported that due to lack of information they sometimes had to sell fish at low price due to over supply of fish in the market.

5.3.3.4 Marketing margins: Share of consumer's price

In all 52 cases in the study retailers transported fish directly to retail markets and sold to consumers. On average one retailer traded 22 (\pm 14.6) kg fish daily buying from

auction markets at Taka 44/kg (± 16.15) (USD 0.71/kg) and made Taka 158 (± 121) (USD 2.55) net profit (at Taka 7/kg). Consumers paid Taka 54/kg (± 16.3) (USD 0.89/kg) at retail markets. From those transactions farmers received 69% of the price paid by the final consumer (Figure 5.17). Auctioneers received 4% at Taka 2.5/kg. One auction house transacted averaged about 326 kg/day (as mentioned by the auctioneers) The people providing support at auction and retail markets and during transport shared 3% of the price paid by consumers. The ‘support people’ (as mentioned in the graph) included assistant at auction, water suppliers, ice suppliers, market and transport *Kulis* and cleaners. Transport comprised 4% of consumer’s price (transport included fish transport cost to auction market paid farmers, fish transport cost paid by retailers and retailers own cost).

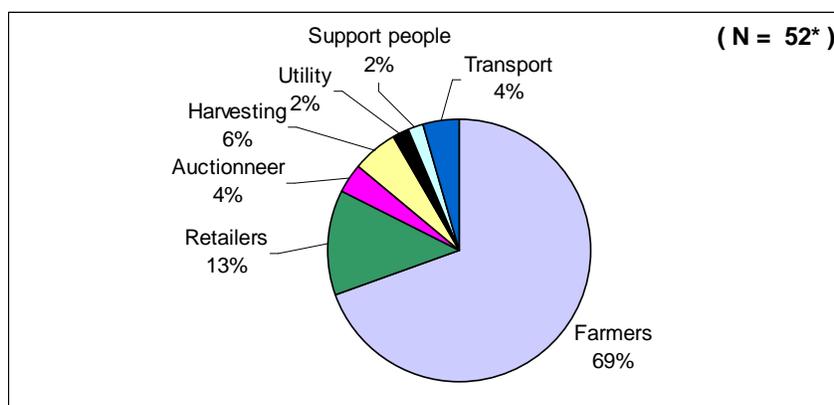


Figure 5.17: Share of consumer's price received by stakeholders in Dinajpur

5.3.3.5 Growth of rural fish markets and employment in the fish marketing

From FGDs with fish farmers it was found that 16 new markets have been established (including road side places) where fish is sold regularly within 10 km radius of sample villages during last 10 years. The growth of new fish markets established within 10 km radius of villages is shown in Figure 5.18.

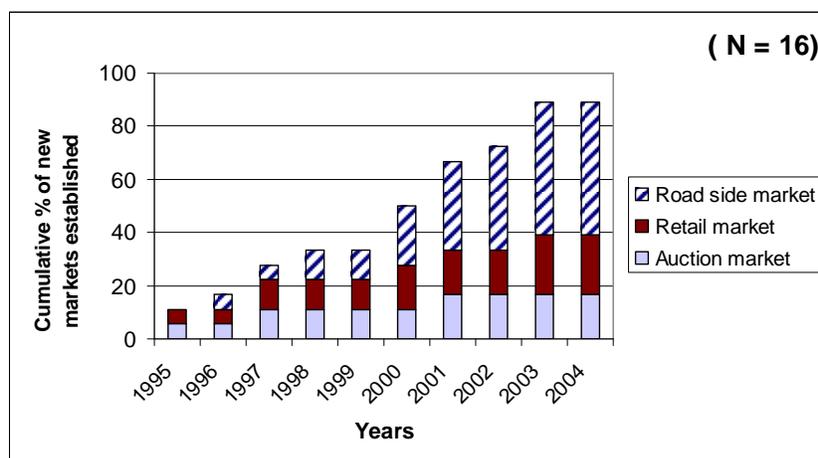


Figure 5.18: Cumulative % of rural fish markets established within 10 km radius of two sample villages in Dinajpur during 1995-2004

Three auction markets where the farmers (from one sample villages) sold their fish studied details for fish marketing. A total of 360 people were employed at those auction markets including the fish retailers who buy fish from those auction markets (Table 5.10). The number of people working at wholesale markets averaged 120, but varied widely from 43 to 221 with the size of the market (amount of fish transaction). The retailers comprised (67%) among stakeholders, followed by auctioneers (6%) and managers (6%). Except auctioneers and managers, the rest of the people involved (88%) are poor. It is important to note that some retailers buy fish from different auction markets on different days.

Table 5.10: Number of people working in three auction markets in Dinajpur

	BahadurBazar	Ranigonj	Ranirbander
Auctioneer	12	4	4
Manager	12	4	4
Retailers	145	25	70
<i>Koilder</i>	19	0	4
<i>Kuli</i>	8	4	5
Helper	12	2	4
Water suppliers	8	1	1
Cleaner	3	2	3
Tax collectors	2	1	1
Total	221	43	96

On the other hand, people in the retail markets averaged 25 ranging between 12 and 42, of which almost all have been retailers except one cleaner and one tax collector for each retail market.

Results of the questionnaire survey of 149 intermediaries from sample fish markets (3 auction and 6 retail markets) surveyed in Dinajpur shows that 58% of the intermediaries had been working since previous 10 years. A gradual increase of number of people in fish marketing was found over the previous 10 years (Figure 5.19).

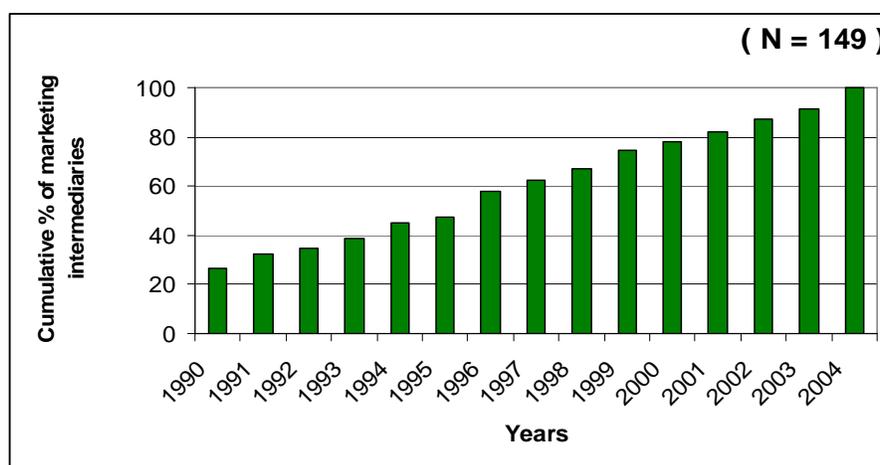


Figure 5.19: Cumulative % of stakeholders involved in fish markets during 1990-2004

5.3.3.6 Access to job opportunities in fish marketing:

Previous employment of stakeholders and the reasons of changing jobs were investigated. Results show that the stakeholders had a wide range of previous professional backgrounds.

Forty five percent of the people working in fish marketing in Dinajpur were from different employment backgrounds, 28% changed their position/auction house within the marketing chain and the rest (27%) had entered without any employment background.

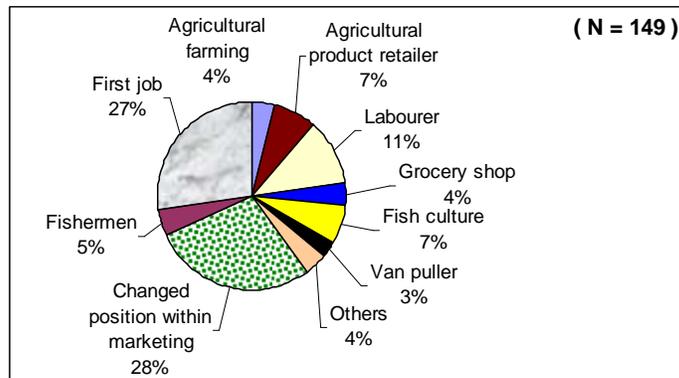


Figure 5.20: Last job for fish marketing stakeholders in Dinajpur

There were several of reasons stated by the stakeholders to become involved in fish marketing. The reasons were grouped under 9 major categories and presented separately for the people changed position within the marketing chain and the people joined from outside of the fish marketing chain in Figure 5.21.

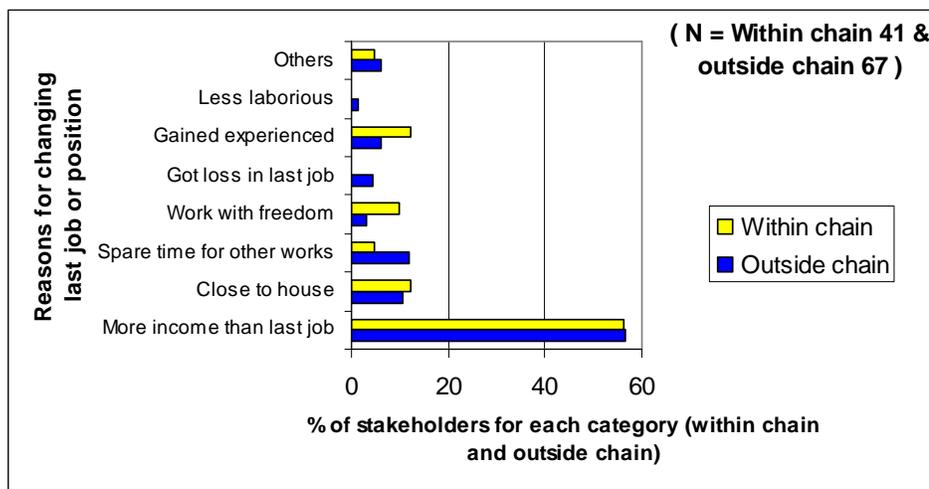


Figure 5.21: Reasons for seeking job in fish marketing (i.e. changing last job)

Overall, “more income than last job” was found the most important reason for 56% of stakeholders, which was followed by work opportunity “close to home” (12%) and “gaining experience in fish marketing” (12%).

5.3.3.6.1 Impact of fish marketing on livelihoods of stakeholders.

Fish marketing stakeholders in Dinajpur were asked about their annual income and their source. The results show that 33% of the stakeholders had only one source of income i.e. income from working with fish marketing, 39% had two income source, 23% had 3 sources and 4% had 4 income sources. However, income from working with fish marketing contributed the greatest proportion (73%) of the total household income for the stakeholders (Figure 5.22) and was significantly higher ($p < 0.05$) than that of other sources.

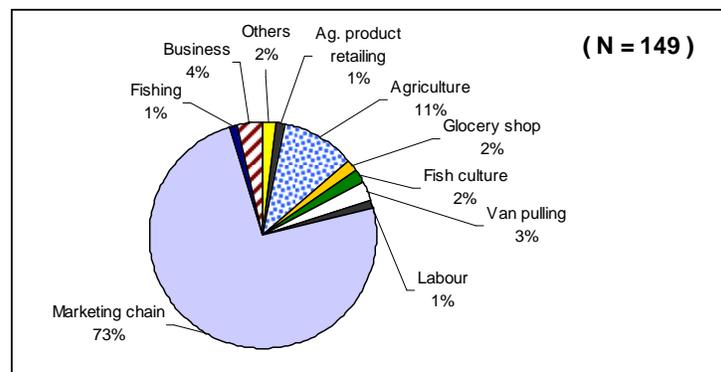


Figure 5.22: Proportion of household income from different sources for fish marketing stakeholders in Dinajpur

The overall mean household income for stakeholders was USD 864 and varied widely among the different professional groups in the marketing chain (Figure 5.23). The mean annual household income of auctioneers (USD 2272) was significantly higher ($p < 0.001$) than that of other stakeholders.

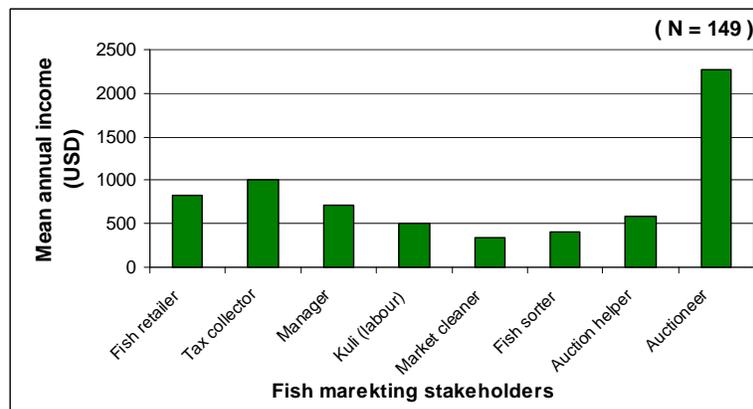


Figure 5.23: Mean annual household income for different level of marketing stakeholders in Dinajpur

5.3.3.7 Improvement in livelihoods of marketing intermediaries

Stakeholders were assessed regarding the changes in household livelihood over the last five years and the factors that influenced the changes. Livelihoods changes were grouped under i) improved, ii) remained similar or iii) deteriorated and are presented separately for auctioneers and other stakeholders together (as “employee”) in Figure 5.24.

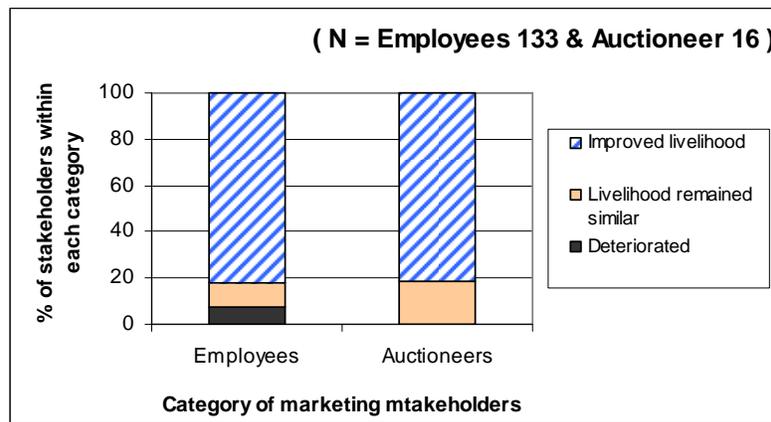


Figure 5.24: Livelihood change over the last five years

Household livelihoods of 81% of the marketing stakeholders were improved over the last five years and were remained similar for 15%. Livelihood became deteriorated for 4% of the stakeholders and all of them were from the employee groups (Figure 5.18).

Increases in income from different sources was the main factor that influenced improving livelihoods. The stakeholders pointed out a combination of different factors contributed to improving livelihoods, which are grouped into 9 main categories and was shown against auctioneers and employees in Figure 5.25. Employment in fish marketing, i.e. income from fish marketing job was the most important factor for 75% employees, which was followed by “increase of agricultural productive assets” 35% and “started own business” 24%.



Figure 5.25: Factors contributing to improve livelihoods for marketing stakeholders

The main causes for livelihood remained similar or deteriorated for all stakeholders is shown in Table 5.11 and Table 5.12.

Table 5.11: Reasons for livelihood remain similar for intermediaries

Factors influenced for livelihood remained similar	Number of stakeholders	
	Auctioneers (n=3)	Employee (n=14)
Family split-earning member decreased	0	4
Family member increased-expenditure increased	2	5
Income decreased-due to loss in business	2	6
Ill health-income decreased	1	5
Income/salary remained similar but expenditure increased	0	3
Daughter/sister's marriage-spent lot of money	1	2

Table 5.12: Reasons for deteriorating livelihood for intermediaries

Factors influenced for livelihood deteriorated	Employee (n=10)
Family split	3
Family member increased-expenses increased	2
Business reduced	4
Ill health- can not work properly	7
Expenses for daughter/sister's marriage	4

Multiple outcomes were referred to livelihood improvements by stakeholders. The indicators are grouped and presented in Figure 19. There was a remarkable difference in livelihood outcomes referred between the employees and auctioneers. Improvement in food were the main outcomes for the employees. Food and clothing were improved

for 90% and (73%) followed by education (40%). While, on the other hand, the main improvements for auctioneers were education (77%), healthcare (54%) and repayment of loan (46%) (Figure 5.26).

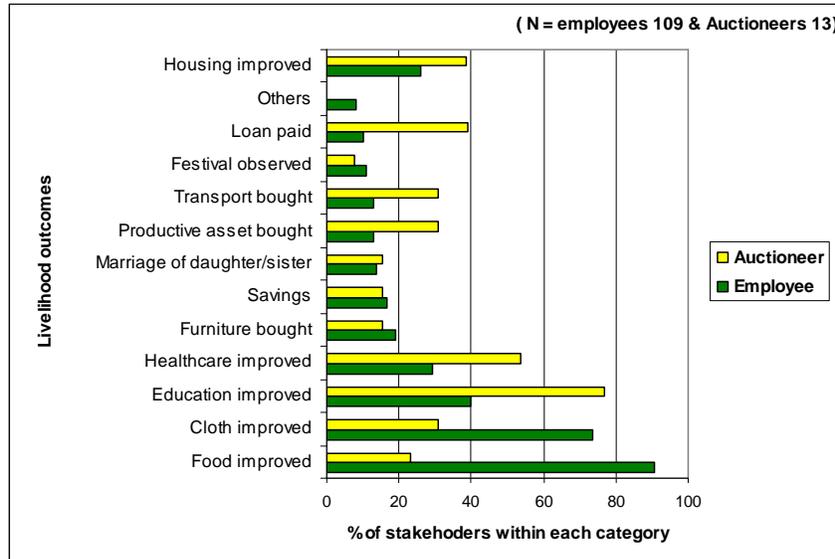


Figure 5.26: Livelihood outcomes for marketing stakeholders in Dinajpur

5.4 Discussion

Results obtained and presented in section 5.3 of this chapter on freshwater aquaculture in Dinajpur indicates that small-scale aquaculture production which includes conventional pond fish culture and integrated rice-fish, and marketing had clear positive impacts on rural livelihoods. The gradual improvement of small-scale aquaculture (pond and rice-fish) over the last 10 years (CARE, 2001) and growth of fish marketing enhanced rural livelihoods. Aquaculture along with integrating pond-dike vegetables benefited the small farmer's through income and fish consumption in Dinajpur (CARE, 2001). However, there were other stakeholders at production level who were benefited from aquaculture. The findings of the study in Dinajpur are described in three main headings below.

5.4.1 Livelihood impacts of small-scale aquaculture at village level

5.4.1.1 Livelihood impact of farmers:

Rural livelihoods in Dinajpur district are dominated by agricultural farming systems in (CARE, 2001). The farming systems are changing through various types of crop diversification, but still rice and vegetables dominates the farming systems (Hoque, 2000).

The Northwest region of Bangladesh is generally considered to be one of the poorest in the country (WFP, 2002). The regional economy is predominantly agricultural and vulnerable to climatic variability (CARE , 2005b). In the higher parts of the region drought is a common occurrence, whereas the districts located along the major rivers often experience extreme flooding. In this context aquaculture including rice-fish farming had an important contribution to livelihoods.

The study revealed that aquaculture, which includes both rice-fish and pond fish culture, made an important contribution household income and livelihood of majority

of the sample rice-fish farmers (81%). The average household income found in the study (USD 1231) was slightly higher than national average household income (USD 1168) in 2000 (BBS, 2004). However, household income was increased for majority of the rice-fish farmers in the recent past. While several income sources contributed to farmers' household income which is a common phenomenon in rural Bangladeshi families (Lewis, 1997; Sen, 2003), increase of rice production and rice prices was the main contributor to increased income. Historically, the agriculture in the north-west (includes Dinajpur) is dominated by rice cultivation. Although, in a changing rural economy agricultural crop production was on diversification since the recent past (Bakht, 2000), rice production still dominates to influence livelihoods of rice-fish farmers (Ateng, 2006; CPD, 2006).

More than three quarters of rice-fish farmers pointed out that an increase of rice production together with integrating fish in the rice fields contributed the most to improved household incomes. The contribution of income from rice to the total annual income (37%) was found highest among the income sources and much higher ($p < 0.05$) than that of other sources. Rice-field productivity was enhanced in three ways; firstly an increase of small-scale irrigation facilities allowed cultivating of *boro* rice in dry season in more areas (Brabben et al. 2004). Irrigation has a multiplier effect on as it increases fertilizer efficiency, soil fertility etc, which ultimately increases rice production (Hasnip et al. 2001). Secondly; it encourages introduction of high yielding rice varieties (HYV), which further increase rice yield. The cultivation of HYV *boro* rice together with improved irrigation and adaptation of modern cultivation practices yielded more rice than rain fed *amon* rice (BBS, 1999). Finally, integration of fish with rice cultivation to both irrigated and rain fed rice. The integrated rice-fish system not only yielded fish from rice fields, but also increased rice yield and reduces costs by enhancing rice-field ecosystem in many ways (Gupta et al. 2002). The increase of productivity improved the rice-fish farmers' household income.

The increase of farm income impacted positively to diversify income sources to both non-farm and on-farm activities. Some of the farmers established small grocery shops or tea shops in the villages or along the *paka* roads or in the rural markets and employed the family members or rent it out to others, while some others bought vehicles that had rental value (Toufique, 2001). Some of the better-off farmers bought water pumps that could be rented and/or sold water to other farmers for rice field irrigation in *boro* season (Brabben et al. 2004). The on-farm income diversification also included home-based small-scale cattle or poultry rearing. These types of diversification not only increased immediate income, but also improved the asset base, without which the reliance of the rural poor could not be sustained. The importance of an improved asset base has discussed in earlier chapters.

Fish contributed relatively little (17%) to total household income. Fish production is generally low in Dinajpur which is linked to water availability. The northwest is the driest part of the country and poor water retention capacity and low fertility of soils compared to other parts of the country (Islam, 2002).

Although income from fish is low due to lower productivity, fish produced on the farm was a significant source in household consumption. In the northwest approximately half of the fish consumed by farming households was sourced from their own farm. The annual per capita fish consumption for all farming households found 11.2 kg was higher than the 7.1 kg found by Griffiths (2000) for northwest fish farmers in 1997. Both worse-off and better-off farmers similarly benefited regarding fish consumption from on-farm sources as there was no significant difference in fish consumption between two farmer categories. Thus the increased income and consumption impacted positively in overall livelihood outcomes for the majority of the rice-fish farmers in study villages. AIT/DOF (2001) found that the majority of fish farmers in the north-west culture fish mainly for home consumption and they consumed more than they sold. But this study found that about two thirds of the fish now produced in the study villages were sold to market. This suggested the increase

in fish production, which reduced the proportion of fish consumption, but not the amount and indicated a shift of farmers' attitude and managements towards more commercial aquaculture in recent years.

5.4.1.1.1 Livelihood impact on aquaculture labourers

In a changing agricultural farming systems with crop diversification, rice and vegetable still dominate the farming systems in Dinajpur district (Hoque, 2000). Most of the manual labour force in Dinajpur district were found to be employed in rice and vegetable cultivation as cultivation of both rice and vegetable farming are labour intensive (Mahmud and Shively, 2004). While aquaculture practices in Dinajpur were found to be improving gradually including expansion of rice-fish farming (Barman et al. 2002; Islam, 2002), farmers interest was intensified with a change to more commercial farming. This has opened the opportunities for labourers to be employed part-time in aquaculture over the last 10 years. Although the work opportunity in aquaculture had increased in the recent past, it was not yet significant in rural livelihoods compared to rice and vegetable cultivation. One fifth of the agricultural labourers now found employment part-time in aquaculture although the impact of work opportunity was still limited (1.5 day/week). However, the real labour wage was found to increase from Taka 53 to Taka 66 over the previous 10 years. Rahman (2003) found the daily wage rate for rice labourers was Taka 48 in 2001. The increase of labour wage should to be linked the overall increase of labour demand in rural areas in the region. Agricultural labour demand in the north-west part had increased with diversification of agriculture (Mahmud and Shively, 2004). Kanwar (2004) found a strong relation between labour demand and rice productivity and price. The promotion of non-farm rural activities, which absorbed a good amount of rural labour force, also had a positive relation with increase of labour demand and wage rate in rural areas (Deb, 2002).

From the current trend it can be projected that the employment opportunity in aquaculture would be increased in future with the increase of intensification pond aquaculture and expansion rice-rice expansion.

5.4.1.2 Livelihood impact on fishers (fish harvesting team in pond).

A declining natural fishes had led professional fishers in Dinajpur becoming more vulnerable and pushing them to engage in different earning activities. Aquaculture production and marketing provided fishers with opportunities to diversify income activities to reduce vulnerability (Ahmed and Lorica, 2002). The majority of professional fishers had shifted their main employment from fishing in open waters to harvesting ponds. While the northwest region is poorest in natural open water resources, expansion of irrigated rice cultivation in low lying areas and natural *beels* and use of pesticide has led to sharp decline of natural stocks (Barman, 2001; FAO, 2001c). In contrast, the gradual expansion of aquaculture has provided them with an opportunity to engage in harvesting fish from pond and rice-fish plots. The fishers were found to harvest ponds about three days per week in sample villages. The work opportunities have largely depended on the level of intensification of aquaculture in individual villages. The working days with ponds for fishers was found to be much higher in one of the four sample villages. This was because this village was more advanced in aquaculture practice with fingerling nurseries, pond fish and rice-fish farming. The increase of employment based on harvesting fish has contributed to increasing real daily incomes remarkably to USD 1.2 for the fishers from USD 0.7 10 years ago.

The fishers were also found to have diversified into fish retailing, particularly in the rural markets. Dry season (January-March) was the lean period for fishers as most the open water bodies have dried up and catching wild fish and harvesting ponds becomes greatly reduced (Rashid, 2005). This period has been described as most vulnerable in a year for the fishers and they became involved in fish retailing in the rural markets

(Kleith et al. 2003). More than one thirds of the fishers were found to have been involved in retailing fish. Finally, in some cases fishers, when there was no option available worked in ponds, rice-fish plots and other agricultural activities such as day labour. In a livelihood study on *Asura beel* in Dinajpur Islam et al. (2006) found 11% of the professional fishers were involved in agricultural wage labour during the lean period. The current study found 19% of the fishers in sample villages worked part-time as agricultural labours.

Employment in pond harvesting is clearly critical for survival for fishers. However, these opportunities together with other income generating activities, like retailing fish contributed in improving livelihoods outcomes for majority of fisher from sample villages in Dinajpur over the last 10 years.

5.4.2 Role of women in integrated aquaculture and impacts on women

5.4.2.1 Women's involvement in aquaculture

Like other parts of the country rural women in Dinajpur are restricted by *purdha* norms. The status of rural women is outlined in earlier chapters. Yet women from rice-fish farming household were found to carry out aquaculture activities, of which the majority of the women were involved in fish feed preparation, feeding and growing vegetables. These activities are commonly performed by women in Bangladesh, because of their inherent links with agriculture (Talukder et al. 2001). In a study Barman et al. (2002) found that mobility women from small-scale fish farming households in north-west region of Bangladesh was mostly limited within homestead areas and most of the women fed fish and mannered ponds and only a small number of women were involved in pond preparation and harvesting. The women spend a higher proportion of their time in livestock and poultry rearing (Paul and Shadullah, 1991). As the northwest region is dominated by cereal crop and vegetable production women probably have greater involvement in those activities

(Oakley and Momsen, 2005; Haque, 2007) particularly crop and seed processing (Rahman, 2000). However, along with above pond activities a small proportion women in study villages were involved in repairing pond and harvesting fish. This can be attributed to individual household economic condition and resource base (Kevane and Wydick, 1999).

Women's level of involvement was also reflected in their overall expression of workload. The majority of the women felt that their overall workload was not increased significantly through carrying out aquaculture activities as they spent less than half an hour daily on aquaculture.

Quantitative assessment of some specific events of ultimate outcomes and benefits for women indicated that women's decision making was enhanced to some extent. Half of the women were found involved in decision making mostly around the three activities they performed (Zaman, 2000).

5.4.3 Freshwater farmed fish marketing in Dinajpur

The study focused on access of farmers to markets, existing farmed fish marketing process and margins, overall effect on aquaculture production and finally impact on stake holder's livelihoods.

5.4.3.1 Freshwater farmed fish marketing chain and process in Dinajpur

Markets for fish produced in the study areas in Dinajpur were very localised. The farmed fish were channelled to local consumers through local markets. This was due to a high demand for fish compared to the local supply in the area. CARE (2001) found that farmed fish produced in the north-west was normally consumed within a radius of 40 kilometres from the point of catch, and quite often the distances to retail markets did not exceed five or ten kilometres. Therefore the marketing chain for local farmed fish was shorter than it is commonly described (FAO, 2001a; Muzaffar and

Helaluddin, 2001). Most of the fish only passed through two levels of intermediaries between farmers and consumers. In rare cases it passes three levels when fish has been sold to harvesting team and harvesting team sold it to professional retailers.

As the demand for fish was not met by the local supply a good quantity of fish was imported from other districts including marine fish from Cox's Bazar and neighbouring countries in India and Myanmar (Islam et al. 2004b). CARE (2001) found that the local produce contributed only 30% of the fish purchased from markets in the north-west districts and the rest being imported. Dinajpur auction market was found to be the central market for assembling and distributing local and imported fish to different rural and urban retail markets. The distribution of fish depends on the demand of fish for different markets as majority of large and high value fish were sold in town markets, while cheaper and small sized fish were channelled to rural retail markets. Ahmed and Lorica (2002) suggested price elasticity of demand for big fish is higher in the urban areas than in the rural areas for all income groups, while the level of household income was related to demand for consumption for various fish species groups (Huang and Bouis, 1996). In a recent study in West Bengal in India Barman et al. (2004) observed a much higher demand for small and cheap fish in rural areas than urban areas. They found that fish retailers including women food fish hawkers buy small (100-200 g) and cheap fish (like small rohu, catla, silvercarp, tilapia, small shrimp etc.) from urban auction markets and sell to rural markets and door-to-door in villages (Barman et al. 2004).

However, the recent growth of rural auction markets have affected the marketing dynamism and stimulated decentralized fish marketing and distribution patterns. The fish markets, which included auction, retail markets and roadside markets, were found to increase in number in the rural areas. The study found that 8 new markets were established within a 10 km radius from the sample villages over the previous 10 years. The case studies showed that growth of markets was driven by the combined effect of increased demand of fish due to a growing population and increase supply of fish

from aquaculture. The expansion *paka* roads also had a positive influence in the growth of the markets (Bakht, 2000; ADB, 2001).

Most of the farmers from sample villages sold their cheap and small fishes in closer rural auction or retail markets. Fish farmers from Telipara village sold 70% of their sold fish to a closely located auction market. Before the closer market had been established they used to sell them to the town auction market. Thus easy access to markets both in terms of distance and relations with auctioneers as well as time required for marketing is critical. However, the price of small and cheap fishes did not differ significantly between rural and town auction markets as the demand for those fishes was higher in the rural markets due to low income level of rural people (Dey, 2000). Thompson et al. (2000) found that fish consumption of non-pond rural people declined by 30-40% during 1991 -1999 and their consumption also changed in favour of low priced and smaller cultivated fish like silver carp and Thai shorputi. The growth of markets in rural areas was very important for ensuring fish availability in rural areas, particularly for poor non-pond households. Moreover, cheaper prices could be maintained as the transaction costs were less for short marketing chains. The value addition activities of fish products between farm and consumers were minimal as most fish were sold fresh to consumers due to consumers' preference and short-chain transactions.

The study found that auction markets were not only a transaction centre, but also supported fish production and marketing in different ways. Auctioneers were not just another set of intermediary in the chain, in between the producer and the consumer, taking commission. Auctioneers generally much wealthier than all other market players, were also major investors in driving the supply chain. The auctioneers also provided credit to farmers to secure business volumes as they operated with very small margins, their income depended upon quantity of fish traded. The producers were compelled to use his services and did not require dealing directly with market retailers as auctioneers paid to farmers on the spot for their product. The retailers took

fish on credit from auctioneers, which ensures more buyers for producers and ensures competition in bidding process (CARE, 2001). The credit to retailers from auctioneers also allows poor people, like retailers to enter the business.

While auctioneers invested in the whole marketing systems other stakeholders like *Kuli*, cleaner, helper, *Koilder* provided important services for efficient operations in return for their small regular earnings. These people gained the smallest share of consumer's price ranged between 0.17% – 0.32% and their daily income from fish marketing ranged between Taka 47 and 99.

Margin analysis is a useful tool to assess the efficiency of marketing systems, specially when complemented with information on marketing costs and risks, providing insights into the existing degree of market competition and marketing strategies which could yield significant benefits to producers. The study identified that fish farmers gained more than two third of the consumer price which was higher than has been found by others eg. 56% (Alam, 2000). In a study in Rangpur and Thakurgaon district in the northwest Bangladesh CARE (2001) found that the farmers share of retail price varied with different species and ranged between 70% and 85%. The higher share for farmers found in the study can be attributed to short marketing chain which reduces transaction cost, low value addition activities and farmers direct marketing. Pingali et al. (2005) noted that evidence suggests increased transaction costs results in less competitive markets for farmers and deters entry of small farmers into the market.

However, the share of the consumer's price varied considerably among the stakeholders. Marketing margins can be influenced by retail demand and farm supply as well as other factors like time lags in supply and demand, market power, risk, technical change, quality, and transaction costs (Wohlgenant, 2001). Among the intermediaries retailers received the highest share (13%) of consumer's price which equals to Taka 7.5/kg. But as each retailer traded small quantities of fish daily (22.5

kg) they were only able to earn Taka 163 per day on average. The share of consumer's price for retailers found in the study was little higher than that was reported (10%) by Muzaffar (2004). However, retailers have to cover most of the risk for the highly perishable fish product as end sellers as well as they sold fish in fresh form. The risks includes deterioration of fish quality because of longer selling time due to less number of buyers, which consequently led the retailers to sell lower price (Chimatiro, 1998).

While the marketing intermediaries are commonly viewed as unfair profit taker, the study revealed that the overall shares of retail price for different level of stakeholders could be consider as fair, on which they live on with their families and also ensuring a fair share for fish farmers.

5.4.3.2 Farmers marketing practice

Diversified options of selling fish provided the farmers with the opportunities to fulfil their primary requirements of marketing their fish as farmers were able to sell any fish any time regardless to species and size. This had been due to the large gap between demand and local supply (Parveen and Faisal, 2003). The study found that two thirds of the farmed product was sold to market. Individual farmers was found to use different selling options according to their requirements. Ahmed et al. (1993) also found that fish farmers in Gazipur used different markets for selling their fish. Selling agricultural products like chicken, eggs and vegetable in different markets is a common practice (Islam, 2003). The study revealed that three factors had determined the selection of the selling option and overall farmers marketing practice. Firstly, the product quality and quantity. The farmers considered demand of fish for different markets. About half of the fish produced in the villages were sold in auction markets mainly due to the higher price than selling in retail markets. Farmers usually sold bigger size (>750 g) and/or high value species like Indian major carps as well as higher quantity of fish in urban markets (Shafer, 2000). Secondly access to markets,

particularly auction markets both in terms of communication and relation with auctioneers. Although improvement in road communication in the recent past has reduced remoteness of the most villages (CPD, 2001), farmers tried to sell fish in the markets more convenient to them. Ahmed et al. (Undated) notes that trust and informal relationships (networks) among farmers and traders play an important role in determining exchanges and being able to reduce market inefficiencies. Most of the farmers from study villages, particularly small-scale farmers sold their fish to rural auction markets even at slightly lower prices than town markets, considering the distance, transport cost, time require for selling in town markets as well as good relation with auctioneers.

However, the distance of markets from the village, particularly auction markets did not have much effect on selling fish to different markets. The study found that the bulk (76%) of the fish from Volanathpur was sold in Dinajpur auction markets, which was located 16 km from the village, while only 11 % of total produce in Sharderpara was sold at an auction market which was only seven km from the market. Perhaps more importantly socio-cultural trends and traditional practice determine where households market their fish. Marketing of fish farmers from sample villages was not entirely driven by the price (higher) and access regimes, rather in some villages it was depended more on the local socio-cultural environment and traditional practice. The considerable differences observed in farmers direct retailing fish in between sample villages were due to difference in socio-cultural value for individual village. In Sharderpara, most farmers were found to wholesale their fish to professional retailers at retail markets, while in Gongapur farmers preferred to retail their fish directly to consumers.

Thus, although farmers marketing practice in Dinajpur has been largely dependent upon local social values, the interaction between farmers and markets had found on increasing trend, which resulted in increasing awareness for farmers about their

products and ultimately has enhanced aquaculture. Growth of rural markets further enhanced the access to market, particularly for small-scale farmers.

5.4.3.3 Employment in fish marketing and impact on rural livelihoods

Fish marketing in Dinajpur was not only providing mechanisms of product exchange, but also it was playing an important role in providing employment for local people. The study suggested that about 350 people, including the retailers and auctioneers have been employed in the four auction markets studied. The employment generated in fish marketing was very crucial, particularly for the poorer people as Dinajpur district is characterized by lower income levels compared to other parts of the country (Lewis et al. 1993; Lewis et al. 1996). The rural labour force in Bangladesh is growing at about three percent annually (Omore et al. 2004). This increasing labour force in developing countries may not be absorbed productively in on-farm work given the limits to arable land and increases in agriculture only. Employment opportunities in rural areas may have to rely on strengthening the ability of non-farm agricultural activities to absorb the labour (Omore et al. 2004). Marketing activities, particularly for perishable commodities, are usually a significant labour absorber (Ahmed, 2002). The study found that the number of fish markets including the road side markets had increased gradually over the years. This certainly generated new employment opportunities mostly for poorer people like retailers, *Kuli* (labourers) and cleaners. On average 19 people were found to employed at rural retail markets of which the majority were retailers. A gradual increase of number of people involved in fish marketing in Dinajpur also provided evidence of generation of livelihoods for people over the years.

Access to employment for the poor is critical as they often possess poor human capital and social networks as well as capital for investment (Reardon et al. 2001). The composition of the people working with fish marketing indicated that the poor people had access to employment. From the income and asset base of the marketing

intermediaries it can be found that vast majority of them (94%), with the exception of auctioneers, were poor. Among those intermediaries cleaners, dressers, *Kuli* (labourers) and water suppliers as poorest of the society and cleaners were lower caste Hindu (Khatun, 2004). Furthermore, about half of the people involved in fish marketing were from a wide range of different employment background. This suggests that the employment opportunities were open for various section of the rural society.

Diversification of livelihoods for poor people, particularly rural poor is a common phenomenon in many developing countries including Bangladesh (Ellis, 2000a; Barrett et al. 2001; Barrett et al. 2001b). The employment in fish marketing in Dinajpur supported the stakeholders to diversify their livelihoods for smoothing the income in many ways. Through the income from fish marketing, they were able to invest on on-farm income generation activities like agriculture, livestock, poultry and fish culture as well as non-farm activities like small shop (Toufique and Turton, 2003). One thirds of the stakeholders mentioned that one of the important reasons of working in fish marketing was that they had spare time to be involved in other works since most auction and rural retail markets operates half a day (either in the morning or in the afternoon). Previous experience also aided them to be involved in other income activities. Many of the stakeholders who had experience working as a labourer (11%) have found work outside of fish marketing. The retailers who had background of fishing (5% of total stakeholders) in open water or harvesting fish from ponds often switch between retailing fish in the market and harvesting fish from ponds in different seasons as suitable to them. (Rahman et al. 2002) found the fishers retailing fish in the off season and (Kleith et al. 2003)found professional fishers in coastal Bangladesh were involved in both fishing and fish retailing. Such switching of retailing has also been found with them who had experience of retailing other agricultural products, like vegetable (7% of total stakeholders). The cleaners have been found working at other places. The flexibility provided in the marketing

employment facilitated the stakeholders to smooth their income during vulnerable period and thus gaining greater livelihood security.

Although gaining “more income than the last job” was the main target for marketing stakeholders joining in fish marketing, a wide range of other needs were also met through the employment. Finding employment opportunity in marketing employees closer to house aided them to stay with family (who used to migrate) and to be involved in agricultural work and reduce their own transport costs were also important. Living with the family is important in Bangladesh where social security is inadequate (Kabir, 2002). Therefore, the impact of the employment was much greater to the employees than only income.

The income and other benefits gained from the employment in fish marketing had significantly contributed in improving livelihood outcomes for the majority (81%) of stakeholders over the last five years in Dinajpur. The improvement was found both for employees and auctioneers. Although the majority of stakeholders had 2-3 income sources which is common to many developing countries (Barrett et al. 2001b; Sen, 2003) earning from fish marketing comprised three quarters of the total household income. Earning from the employment assisted them to improve their other productive assets portfolio like land, cattle, van etc. Improving the asset base of the poor is crucial in Bangladesh where land holding is very unequally distributed. Rural poor households often lack the assets that serve as important capacity variables for participating in non-farm income activities (Choi, 2004). In terms of unequal access to more remunerative non-farm income access may cause further concentration of wealth, in the form of land. The resources accumulated by marketing stakeholders also contributed in improving livelihood outcomes for them. Improvements were observed both in basic needs and social status. The social status was improved through several ways; increase of social interactions, increased participation in social events, visiting relatives and organizing marriage for daughter or sister. Improvement in social status in turn enhanced social safety nets for stakeholders.

CHAPTER 6 General discussion

6.1 Introduction

This Chapter elaborates the broader findings of the research and compares the findings across the study sites. This chapter also reviews the broader hypothesis “Aquaculture production and marketing have significantly enhanced rural livelihoods in Bangladesh.” (Chapter 1) and finally offers some concluding remarks.

The links between poverty, economic growth and the social context including institutions, like markets, communities and households has been established in the rural development arena (Khan, 2001). Although poverty is a multi-faceted concept, growth is the most important factor in sustainable poverty reduction (Thorpe et al. 2006). The relationship between productivity growth and poverty reduction in developing countries over the last three decades is strong (CSLS, 2003). Khan (2001) suggested that extreme poverty can be alleviated if at least two conditions are met: i) economic growth occurs on a sustainable basis and ii) economic growth must be neutral with respect to income distribution or reduce income inequality. Growth can be obtained in two ways: i) urban based capital intensive industrial growth and ii) rural based agricultural growth (Hossain, 2004a). The first category seems unlikely to make significant contributions to rural development in the near future in Bangladesh (Bakht, 2000). The evidence shows that the second type is most effective in poverty reduction in developing countries, particularly a country like Bangladesh where two thirds of the people live in rural areas, half of them are below the poverty line and agriculture dominates the economy (Bakht, 2000; Khan, 2001; Ashley and Maxwell, 2001).

Growth of agricultural sectors, such as aquaculture, can increase productivity in on-farm and non-farm employment (Edwards, 1999a). Non-farm employment has particular importance in Bangladesh as half of the rural people are functionally

landless and the country's population is on the rise. Growth of aquaculture can enhance the rural economy as well as livelihoods in a variety of ways. Weinberger and Genova (2005) classified the effects of agricultural growth in three ways: i) direct effects: which occur through increases in farm income and generate on-farm employments, increase market transactions and added value and generates non-farm employment and make the product more available to consumers, ii) indirect effects: which occur through increases in the purchase of goods and services as inputs from other industries which enhance local business and services, and create employment and iii) induced effects: which occur through increased personal consumption expenditure as income raises which boosts local business and services and generate employment (Hodges et al. 2001; Hall and Skaggs, 2003)

Despite the declining trend of overall agricultural contribution to the national GDP, aquaculture is growing rapidly in Bangladesh at 6-8% during 1991-2002 and ranks second in the export earning (Ahmed, 2003; BBS, 2004; DoF, 2005). Traditionally aquaculture in Bangladesh is extensive or semi-intensive. However, aquaculture is moving towards more commercial operations from homestead-based, subsistence aquaculture, although there is variation of management practices and production within and among the different regions of the country (Haylor and Bland, 2001; Haylor and Bland, 2001; Gammage et al. 2005). A variety of noble technologies have been promoted along with more intensification of conventional pond fish farming. Many of these appear to have increased yield and income of farming households (CARE 2001; Chapman and Abedin 2002; DANIDA 2004). Despite this increase in production, a clear understanding of the impacts of growth of aquaculture on broader rural economy and livelihoods, and critical linkages with domestic and international marketing are important in policy and aquaculture development is lacking (FAO, 2005b). The current research aimed to explore the impacts of three aquaculture production systems on rural livelihoods in three regions in Bangladesh, with a focus

on rural poverty impacts. For wider understanding a livelihood framework, which is known as “Sustainable Rural Livelihood” was used to explore the impacts.

6.2 Impact in aquaculture at production level

In general, the overall findings from the three study sites has confirmed that aquaculture, as a whole, had a significant impact on the rural livelihoods, although there were variations between the study sites as well as between villages. The production level covers the people and aspects directly involved in aquaculture production. The impacts at production level are divided into three sub-section; producers, non-producer stakeholders and women involved in aquaculture production.

6.2.1 Impact on farming households:

The livelihood impacts of aquaculture were significant and diverse in farming households. The diversity of impacts occurred in four broader ways. First; production technology. Different levels of stakeholders confirmed that aquaculture for rural farming households had shifted away from subsistence production level towards more intensive commercial operation i.e. more production and more profit whilst satisfying household consumption, over the last 10 years. Several other studies also found that aquaculture has been intensified and commercialized from subsistence production over the years (Ahmed, 1992a; Ahmed, 1995; Gammage et al. 2005). Although a similar trend of advancement was found for the three production systems studied, prawn farming in Jessore and pond fish farming in Mymensingh were found to be operated relatively more commercially than in Dinajpur. Commercialization of pond aquaculture in Mymensingh occurred with both fully commercial farms and household based fish ponds. For example many fully commercial farms in Mymensingh adopted monoculture of fast growing exotic species like pangus and tilapia with commercial feeding (ADB, 2005). The home based small-scale farms intensified production with higher input use (Karim, 2006) and commercial management strategy like multiple stocking and harvesting of high value and fast

growing carps. On the other hand, prawn is completely a commercial product introduced within the last decades into farming systems in Jessore. However, there was a wide variation of such commercialization across the regions (Gammage et al. 2005). The promotion of aquaculture production was largely driven by the increased demand and trade of fisheries products in both domestic and international markets (Ahmed and Lorica, 2002; Delgado et al. 2003). Demand for fisheries products is increasing with the growth of population, changing food habits and rapid urbanization (Ahmed et al. 2003; Dey et al. 2005b; Kent, 2003). As aquaculture growth is driven by demand for products support to the poor farmers in improving resource, input use, human capita and social networks would help them to better use the new opportunities. Therefore, future development of aquaculture should specially target poor farmers to build capacity to produce demandable product and thus gain benefits from aquaculture development.

Secondly; household income and consumption. Aquaculture, in general, had a significant contribution to household income and consumption. The average annual income (UDS 1303) for aquaculture farmers was found to be slightly higher than the national average household income. This did not differ much with other studies (DANIDA, 2004; Thompson et al. 2005; Karim, 2006). Moreover household income levels did not vary among the three study sites. More than three quarters of farmers perceived that household income had increased over the last five years mainly through increased farm production and price of the products. "Increase of production" was found as the main reason of increased income across the study sites. Yet when the composition of different income sources in the total household income was compared, the main cash crop, and proportion of that form aquaculture, differed substantially between study sites and production systems. All three studied technologies were integrated aquaculture-agriculture production systems, i.e. prawn, fish and rice was the main cash crop of *gher* farmers in Jessore, pond fish farmers in Mymensingh and rice-fish farmers in Dinajpur respectively. Although individual farming household had

several income sources, incomes from the main cash crops were found to be significantly higher than other income sources. However, the increase of income from prawn and fish occurred through two main ways; firstly improved management practices (e.g. increased input use) and greater experience in producing those crops resulted in increasing production (Chapman and Abedin, 2002; Williams, undated; DANIDA, 2004). Increasing prices due to increased demand were also significant (Dey and Prein, 2006). On the other hand, rice yields in Dinajpur had also significantly increased mainly due to improved private irrigation facilities (pumping of shallow ground water) adoption of high yielding varieties and modern management practices for rice-fish farmers in Dinajpur which significantly contributed to household income (Brabben et al. 2004). Bakht (2000) notes although agricultural crop production has been diversified in recent years, rice production still dominated livelihoods of farmers. Moreover, introduction of fish further enhanced overall rice-field productivity and increased income through fish sales (Barman and Little, 2006; Haque, 2007).

Aquaculture also made a significant contribution to household food consumption. More than half of the fish and vegetables consumed by farming households were sourced from aquaculture production systems. FAO (1999) found a significant and positive relation between aquaculture production and per capita fish consumption.

The effect of increased income was also observed in overall food household food consumption, particularly for worse-off farmers as change in expenditure on food was made in response to changes in income (Regmi et al. 2001). Seale et al. (2003) showed that when household incomes increased by 10 percent, consumers in Tanzania typically increased spending on food by 8 percent; in the Philippines it was 6.5 percent; and in the United States, 1 percent. This consumption impact of increased income was found to be most intense in Jessore as about half of the worse-off farmers increased the number of meals taken per day (from 2 to 3) during the vulnerable

months. In general, increased income also improved other basic needs like housing, health care and education.

Third; Income diversification into non-farm activities. Increased farm income impacted positively on diversification towards other income sources through non-farm activities such as small grocery shops or tea shops, tailoring, buying van, building and renting out shops et. Improvement of infrastructure, electrification and roads resulted in increased human mobility and economic transactions in rural areas created such non-farm opportunities (Bakht, 2000; Mujeri, 2002a; ADB, 2004b). Toufique (2001) notes that rural people have adapted their livelihoods to take advantage of the new opportunities offered by improved infrastructure and communication. Incomes from non-farm sources were found to contribute 31% of the household income. Karim (2006) observed that the non-farm incomes were relatively more important for worse-off households (33% of total household income) than that of better-off households (22%).

Finally; social interactions and mobility increased. The importance of social networks in securing livelihoods is well established through livelihood studies (Sen, 2003). An improvement in social networks of aquaculture farmers were observed in all three study sites. This improvement was occurred in different ways; increased labour sharing and inputs among farmers, social interaction among farmers and relatives, and human mobility. While such sharing and exchange of inputs equipments is part of rural culture (Gupta, 2003), guarding to prevent theft at night in groups by *gher* farmers was unique to prawn farming communities. However, sharing was not restricted to fish farmers. The multipurpose common sharing of ponds is an age old tradition, while Karim (2006) found that pond water was used to irrigate vegetable land of other farmers (non-pond farmers). All the above social interactions are important to enhance social safety nets and such social safety nets may be more crucial in prawn farming in Jessore to protect any negative social implications, which occurred in coastal shrimp farming.

6.2.2 Impact of aquaculture on labourers

The assessment of impacts, particularly income and employment, of agricultural production technology is not complete if only the producer household benefits are evaluated (von Braun, 1995). The benefit goes beyond the participating farms to broader rural livelihoods. The study revealed that aquaculture production systems had significant direct impact on casual labourers, one of the poorest groups in the rural society. In general, intensification of aquaculture, which required more labour for farm management, generated on-farm employment for labourers. This is probably because the requirement of labour could not offset by family labour (von Braun, 1995).

The increase of overall demand of agricultural labour should be linked to broader rural livelihoods dynamics as well as overall labour demand in the rural areas. Several factors may have contributed to an increased labour demand. Firstly, growth (intensive or extensive) of any agricultural sector, which absorbs significant amount of on-farm labour force, it influences the overall labour structure (demand raise) and level of employment in a community (Weinberger and Genova, 2005). Various farm management studies show that intensification of agriculture, for example the shift from traditional varieties to new high yielding rice varieties (HYV) technology, increased overall labour demand in many communities (Hossain, 1988). Barron and Rello (2000) found that commercialization of tomato production in one province in Mexico during 1990s absorbed significant manual labour, resulting in migration of labourers from other provinces and increased labour demand in others provinces.

Secondly, diversification of rural livelihoods to non-farm activities may have an effect on overall labour demand in agriculture. The generation of non-farm activities has been quite sharp over the last decade in Bangladesh (Hossain, 2004b), which absorbed a good amount of the rural labour force, and can affect on-farm labour demand (Rahman, 2004). Finally, increased educational opportunities led many adult family members migrated to urban areas either for higher education or income employment

(Hamid and Shepherd, 2005), which may reduce family labour and increase demand for hire labour in rural areas.

The growth of aquaculture in study villages had a clear and significant impact on increasing labour demand and the employment opportunities for labourers as about half of the agricultural labourers were found to be employed full-time or part-time in aquaculture. Overall, the work opportunities in aquaculture for the three sites had increased from 1 day to more than 4 days per week was further evident. On-farm employment opportunities in aquaculture, when compared across the study sites, was found to be positively co-related with the level of intensification as much more opportunity was found in prawn farming in *ghers* in Jessore and pond aquaculture in Mymensingh than that of Dinajpur. Employment in Jessore and Mymensingh had increased from 3 to 6 days/week over last 10 years for labourers, while in Dinajpur it was now about 1.5 days/week.

The study identified four main direct outcomes of increase of labour demand through integrated aquaculture and employment. Firstly, the labour wage had increased significantly (from USD 0.71 to USD 1.26) over the last 10 years leading to increased household income for labourers. In general, it is expected that increased wage rates effected from increased labour demand and employment from aquaculture would spread the benefits across a broad spectrum of the rural economy (von Braun, 1995). Secondly, the study found that employments associated with aquaculture reduced seasonal income vulnerability. Bangladesh has a marked seasonal pattern of agricultural production that results in large differences in the levels of income, consumption and the demand for labour across seasons (Pitt and Khandaker, 2002). This seasonality of labour demand is typically linked with rice cultivation (Pitt, 1999). However, employment in aquaculture, which has a different seasonality in terms of labour demand helped income smoothing, thus reducing food vulnerability and incidence of seasonal migration for labourers.

Thirdly, fish and other vegetables given by the farmers as incentives made an important contribution to household consumption. The amount of fish for example comprised about one fifth of the household consumption. Such incentives were particularly important in the dry season when there were no opportunity for catching wild fish from open waters (Islam, 2007). Finally, social networks were enhanced with the increase of demand for labourers and income. As a social custom, the incentives given by the farmers to labourers, also helped to maintain good relations to ensure labour availability during the peak season. Such interactions increases social safety nets, which are critical for reducing vulnerability of the rural poor (Alam, 2003). The multiple positive impacts of promotion aquaculture in terms of employment, income, and improvement in social status ultimately improved the overall livelihood of more than three quarters of aquaculture labourers.

6.2.3 Impact on professional fishers

Fishers are another professional group directly involved in aquaculture for harvesting fish and prawn. Although there are a few Muslim fishers, professional fishers are mostly low-caste Hindu and are considered one of the disadvantaged and poorest sections of the society with very poor living conditions (Rashid 2005). In general, several factors such as declining natural fish stocks, access to fishing, increase of number of fishers, lack of financial and equipment support, has further deteriorated their livelihoods in recent years (Rahman et al. 2002; Rashid, 2005). In this context the study evolved that promotion of freshwater aquaculture significantly impacted the livelihoods of those professional fishers. The impacts exclusively occurred through the diversification of livelihoods in many ways, which included full-time employment in marketing networks, full-time or part-time harvesting in ponds, fish retailing and working around ponds as wage labourer. Individual fishers adopted one or more of the above strategies. In a study of the four fisher communities in Kishorgonj, Rashid (2005) found that only 54% of the professional fishers were full-time, 44% combined fishing with other income activities like fish trading, farming, business or had

changed their main source of livelihood to other activities completely. The current study observed that a complete shift of livelihood focus was much higher in Jessore, than in Mymensingh and, especially, Dinajpur. In Mymensingh and Dinajpur, relatively small numbers of fishers have changed profession to small shop keepers, van pulling, other jobs (transport, town shops) etc. In a study (Islam et al. 2006) found that income diversification of fishers was co-related with human and financial capital. Hence, poor fishers in particular suffered in attempts to diversify their incomes into higher income non-fishing activities due to their low level of education and other skills and tended to remain only in fishing profession (Islam et al 2006).

Most of the fishers from the communities studied became involved in harvesting in ponds. Opportunities for harvesting ponds varied between study sites as well as between villages and was related to the level of intensification of aquaculture management, especially harvesting frequency. Many of the fishers in Jessore and Mymensingh were involved almost full-time (5-6 days/week) in harvesting *ghers* and ponds, much more frequently than fishers in Dinajpur. Most commonly, and in all three study sites, fishers were found to switch their income activities to harvesting open access waters and retailing fish, as a way to cope with the seasonal variation of aquaculture opportunities.

The livelihood diversification that employment in aquaculture afforded tended to impact positively on the daily income of fishers. Daily income had increased from under USD 1 to USD 1.6 during the last 10 years and a similar pattern was observed among the different sites. Fisheries policy in developing countries has tended to view fishing as a full-time occupation taking place within a single, well-defined, economic sector. Involvement in aquaculture promoted by many government and NGO was identified as an approach to improving the living status of professional fishers. This includes community based management approaches to public water bodies such as *haors* and *beels* (Sulatana and Thompson 2000; Islam et al 2006). However, Allison and Ellis (2001) argue, the view of defining fishing as a full-time profession may lead

to inappropriate policy development. In the practical context of declining natural stocks and conflict over access to natural waters it can be suggested that several livelihood aspects other than only fishing efficiency, in general and livelihoods diversification in particular, should be considered in policy development in order to alleviate poverty and make natural resource management sustainable. While Rashid (2005) reported a deterioration in the living status of fishers in Keshorgonj, the study found that livelihood diversification, particularly into aquaculture, was critical for fishers to meet and improve their basic needs.

6.3 Role of women in aquaculture and impact on them

Traditionally, in the rural households in Bangladesh, women are primarily full-time housewives. Participation of women in different activities is strongly affected by socio-cultural and, especially, *purdha* norms. However, many of agricultural activities are performed by women; especially poor women. Poor rural women from landless households always undertake odd jobs (like crop processing) preferably inside the house or within the homestead. However, in a changing socio-cultural context and increasing support for women's participation in development (Hamid and Alauddin, 1998) in Bangladesh the study found a greater role of women from fish farming households. While women's participation in fisheries activities is well established in many developing countries (Sharma, 2003), women in the study villages were found carry out limited pond related activities acceptable within the study communities. Many NGO initiatives have also promoted the involvement of women in aquaculture such as establishing group-based leasing of ponds (Shelly and Costa, Undated) and community based fisheries management (Sultana et al. 2001). Rural women in India play a central role in gathering, processing and storing, utilization and management and marketing of many other natural products; for example they contribute the major proportion of the work involved in exploitation of forest products (fruits and wood) (Uma Rani, 1999).

The activities performed by women from farming households in the study villages included the preparation of fish feed, feeding fish and prawns, growing vegetables, harvesting ponds, construction and maintenance of pond/*gher* dikes. Women's involvement in first three activities were common practice and did not differ among the villages and study sites. This can be linked to women's traditional role in agriculture within the homestead, which includes vegetable cultivation, grain processing, feeding chicken and cattle, storing seeds etc (Todd, 1998). However, distinct differences were observed in the number of women performing fish harvest and dike construction. Broadly, the proportion of women carried out these two activities showed a similar pattern between prawn farming households in Jessore and intensive pond fish farming in Mymensingh, which was much higher than that of Dinajpur. This difference can be attributed to more intensified production systems in Jessore and Mymensingh. Intensification of agricultural production system requires more labour and quite often women substitute the labour requirement who can not afford for hire labour. While Von Burn (1995) noted commercialization of agriculture can affect the structure and the level of family labour as well as the distribution of labour by gender (von Braun, 1995). Ahmed (2001) also noted that the introduction of prawn farming in Bagherhat increased womens' involvement in farming.

Upadhyay (2005) noted that although in most societies, women bear the burden of housework and childcare, the feminization of agriculture and the emergent role of women in natural resource management have increased the daily workload outside the home for rural women. While greater involvement in aquaculture, in addition of routine household duties, increased overall workload, the vast majority of women in the study villages were happy carrying out aquaculture activities. This was mainly due to the welfare benefits brought to the households through their effort. Three features can be noted of women's perception of their involvement and household benefits. Firstly that increased household income and fish consumption was the main benefit. While women's greater involvement in agriculture generally saves money on hired

labour, there is available evidence that their involvement in income generation activities increased household income and food consumption (Alam, 1997a; Islam, 2005). Empirical evidence confirms that women taking credit from NGOs for small-scale livestock, poultry or plant nurseries increased incomes and household consumption. Involvement of women in agriculture also has significant impact on household nutrition as traditionally rural women are solely in charge food preparation and distribution. Second; while women's involvement in aquaculture for some families was a 'choice', women from the poorer households defined their role in aquaculture as a strategy for 'survival', through the increased income and consumption that resulted. Finally; some women perceived that they were "helping their husband" i.e. their husbands were fully responsible for income earning activities and they were just assistants. This suggest an undervaluation by women of their own efforts and contribution to household and development in a broader sense (Sharma, 2003), a result of womens' involvement in income generating activities being controlled by men (Siddique, 1998). Building awareness of their own rights for such women needs to be incorporated in future policy and aquaculture development, if women are to be empowered through aquaculture.

Although women as household members benefited from increased incomes and consumption for their contribution in aquaculture, the real benefit is gained in their empowerment (Quinsumbing and Meinzen, 2001). The study findings confirm that women's involvement in aquaculture enhanced their role in household decision making, particularly the aquaculture activities, for the majority of the women. A similar pattern and level (proportion) of women's involvement in decision making were observed between Jessore and Mymensingh, which was slightly higher than that of Dinajpur. This difference can be attributed to greater involvement of women in those two districts. Increased participation of women in household decision making through aquaculture was also observed by Zaman (2000), Barman (2001) and Sultana et al (2001). Women's involvement in small-scale entrepreneurship in poultry,

livestock and other enterprises through NGOs initiatives were found to increase their decision making involvement and capacity (Paul and Saadullah, 1991; Koopman, 1996).

While the majority of the women were involved in decision making on farming activities, their participation in household financial decision making was found to be only medium/ moderate, although apparently enhanced through their involvement in aquaculture. Half of the women could able to decide how to spend small amounts of money independently or were involved in decisions regarding expenditure on childrens' education. Greater financial empowerment was also reported for the women established small-scale entrepreneurship in poultry and livestock through NGOs credits (Paul and Saadullah, 1991; Bahar, 2001; Dolberg, 2003).

Shelly (2005) suggested that even though women's involvement in aquaculture has increased, their full potential has yet to be explored in order to improve their status. However, women's empowerment is not only related to participation of income generating activities, but also involves wider socio-cultural and religious aspects of the rural communities (Kabeer, 2001). Therefore future aquaculture development initiatives involving women should incorporate the socio-cultural and religious aspects as part of the strategy to empower women. Hallman et al. (2003) suggested that women's empowerment can be enhanced in many ways like increasing skill and knowledge, improved understanding of "money matters" (household income-expenditure), working in groups (NGOs groups) etc. Since lack of awareness was found to be an important barrier in the study, awareness building should be incorporated in programmes.

6.4 Marketing of aquaculture and impact on production and livelihoods

An inefficient food marketing system is among the main causes of hunger. Good food system performance is also very important to meet the objectives of participants in

the 'food system' such as remunerative producer prices and accessible retail food prices for the poor, each of which may reduce food insecurity (Rubey, 1995).

The study looked at the existing situation and trends (short term) following four aspects of fish and prawn marketing in three study sites; i) farmers practice and access to marketing, ii) marketing systems and share of benefits and iii) employment in the marketing and impact on livelihood outcomes.

6.4.1 Farmers marketing practice and access to market

Farm gate selling is a traditional practice for farmers. Farmers used to sell their own products either to *nikari* or the harvesting team (fishers) at the pond site (ADB, 2005). Selling at the farm gate to middleman is also widely practiced by small-scale farmers in many parts of the world, who have poor bargaining power compared to organised middlemen resulting in reduced income (Ahmed and Lorica, 2002). However, the study revealed that with greater commercialisation of aquaculture, farmers marketing practices tended to change and fish farmers were found increasingly directly linked with the market. Farmers' marketing was diverse as they availed themselves of multiple options available for selling their fish. The common options were selling to urban/local town auction markets, selling to local markets (wholesale), retailing by themselves at local markets or, selling to *nikari* at farm gate. Individual farmers used different options at different time suitable to them. Such farmers' practice of selling using different markets outlets is also practiced for marketing of other agricultural products like, rice, vegetable, chicken etc. (CARE, 2001; Islam, 2003). For example farmers in the northwest region sell their vegetables in different ways such as to neighbours, *nikari*, retail at local markets, or whole sale at town markets (CARE, 2001). Islam (2001) noted most farmers sell backyard scavenging chickens to middlemen at the farm gate and a few farmers also sold them at local or town markets.

Different types of market (e.g. auction, retail and roadside markets) and marketing channels supported the fish farmers to meet their initial requirements of selling all their fish. The large gap in domestic demand and supply facilitated the farmers to sell virtually any amount of fish at any time (Alam, 2001). Yet selection of markets largely depended upon the quantity, size and species of fish. Farmers tended to sell large fishes in larger quantities at town auction markets, while small fish in small quantities were sold at rural retail markets. A similar pattern was also observed for farmers' vegetable marketing in Dinajpur, Bangladesh (CARE, 2001).

However, although farmers' direct participation in marketing has increased over the years, wide variations also existed between villages regarding farmers marketing practices. This variation was greatest in villages with less intensive commercially orientated aquaculture, where farmers marketing remained largely driven by local traditional practices. Commonly farmers from those villages sold more fish to *nikari* at the farm gate and in local markets. In general more fish was sold directly in auction markets in Mymensingh (70%) district than in Dinajpur (55%).

Increased links between farmers and the market (i.e. selling directly to markets) was mainly influenced by three factors. Firstly, the objectives of aquaculture for farmers, including small-scale farmers, was shifted towards commercialization and maximization of profit, which led the farmers to sell their fish directly to markets to ensure higher income. Secondly; even in the recent past selling fish at the farm gate or in the market was considered as dishonourable in society, leading them to sell at the farm gate to *nikaris*. Social attitudes regarding fish selling have been changing over the years. Finally, convenience (mostly road and transport) was another factor which influenced farmers marketing (ADB, 2005). Increase in human mobility and communication aided the farmers to be increasingly aware of demand and price of fish for different markets as well as the ability to access different markets (CPD-BEI, 2001). In contrast, Sarker et al (2006) argues that small-scale farmers still lacked

improved market access due poor market facilities, particularly bad road communications.

As the farmers were increasingly market oriented their production and product strategy, particularly in commercially operated aquaculture villages, was considerably influenced by market demand and price of fish. Farmers, for example, aimed to produce carp of about 1 kg size as the demand and price of this size fish was high.

In the case of prawn farming, farmers were also supported by the varied opportunities for marketing close at hand and the various services that have emerged to facilitate this. Establishment of *depos* along the *paka* roads (bitumen road) through the villages enhanced physical access but competitions between *depos* enhanced relations with *depo* owners making the selling prawn easy for farmers. An increasing trend in international demand allowed farmers to sell any quantity and grade of prawn at any time; this was particularly important for poor households that could sell very small quantities (0.5-1.0 kg) regularly.

The main weakness of the exiting marketing system is a lack of information services. No mechanism was found to provide information to farmers. Information on current demand and price as well as seasonal fluctuations that could improve farmers decision making regarding marketing strategy and markets outlets was lacking. As most fish is sold through auction markets, fluctuations in daily supply had significant effects on daily price. Over supply of fish on a certain day greatly reduces fish price due to low purchasing power and lower income elasticity of demand in rural areas (Ahmed et al. 1995). Ahmed (2002) noted if farmers depend only on the local village markets to sell their fish products, without knowing demand for fish there will be a tendency for over fish supply in the rural markets. Farmers from study villages had bitter experience of distress selling of fish at very low prices. Likewise, fish farmers in other study sites *gher* farmers were lacking information and awareness of international demand, price and product information.

Although the prime aim of prawn farming was to increase farm income, easy access to markets and the good service from depots was one of the most important reasons for the farmers to be involved in prawn farming which ultimately resulted in rapid expansion of the technology without any external stimulation. Availability and access to marketing information would further enhance farmers' product and production strategy and thus obtain better outcomes from *ghers*.

6.4.2 Fish and prawn marketing systems

Fish marketing is providing the mechanism for exchange of fish products, coordination of buyers and sellers and the allocation of resources in the rural economy. Although fish marketing in Bangladesh has been commonly described as inherently complex due to diverse distribution channels, interactions of various levels of intermediaries and contracts among them (FAO, 2001a; CARE, 2001), fish marketing plays an important role in distributing fish products to consumers in both rural and urban areas through its distribution channels. Market mechanisms that foster delivery of regular food supplies at lower and more stable prices help create food security and reduce hunger (DFID, 2002a). The study identified several strengths and weaknesses of domestic fish marketing and export marketing of prawn.

The study found that the marketing systems, operations, services and facilities for both fish and prawn had been mostly developed by the private sector. The lack of government control interventions (ICLARM, 2001), which probably allowed such opportunities and increased competition, resulting in rapid growth of the markets and the industry, particularly export marketing (Pingali and Rosegrant, 1995; Akiyama et al. 2003). Evidence from Africa (Benin, Madagascar and Malawi) suggests that abolishing or scaling down of state-controlled agricultural marketing boards, has boosted domestic trade in agricultural products through participation of many small operators (Dorward and Poulton, 2001; Fafchamps and Minten, 2002). However, government support in policy as well as developing public facilities is important to

maintain and improve marketing, particularly export marketing. The incremental and intermittent private investments depend on whether there is an enabling policy environment, which preserves private incentives to invest (Tiffen, 2003). The government, in Bangladesh provided support in the form of roads and infrastructure, in general and subsidies and reduced tariff in export marketing with quality control laboratory and certification for prawn export marketing (Bakht, 2000; Khatun, 2004; Bayes et al. 2005). Effective policy support not only favours business growth, but is also important for farmers as when policy and markets work for farmers it attracts farmers' investment and boosts agriculture (Tiffen, 2003).

Growth of markets in both rural and urban areas provided diverse marketing options to farmers and better access to markets. A gradual growth of fish markets in Mymensingh and Dinajpur, and depots in Jessore was observed over the previous 10 years. The growth of markets was driven by increased demand for fisheries products for the fast growing population (Dey, 2000) and export of prawn, and increased and regular supply of fish from aquaculture, and development of infrastructures and roads (CPD, 2001). The growth of markets and road also facilitated better linkages between farmers and markets.

The marketing chains for aquaculture products, both domestic and export, described in the study were shorter than generally described (Ahsan and Ahmed, 2003). Short marketing chains reduce transaction costs and time.

The study found that the major proportion of fish produced by the farmers were sold to markets, mostly through auction markets, which is unlike the marketing of most other agricultural products eg. vegetables, rice, poultry etc.. Although other agricultural products may be sold as wholesale at some point in marketing chain they tend to be sold by negotiation rather than by auction (CARE, 2001; Islam, 2003). The auction process in fish marketing provides open competition among several buyers and sellers, which ultimately benefits both producers and consumers with a fair price

(Kaplan, 2000; Trondsen, 2004). In general, the auction process and operations in fish marketing were found to be similar for Mymensingh and Dinajpur. However, there was no auction process in prawn marketing.

Marketing margins are an important performance measure, representing the value of the marketing service (transport, storage, processing, and others) that are performed on a commodity, including profits as a return to investment, management, and risk (Abdula, 2005). Hence, the analysis of marketing margins provided useful insights as to how marketing costs are incurred and whether they are reasonable or not. The marketing margins found for the different level of intermediaries was similar for Mymensingh and Dinajpur, and can be considered as reasonable. Four main conclusions can be drawn; i) fish farmers gained approximately two thirds of the consumers price in both Mymensingh (65%) and Dinajpur (69%), which was slightly higher than reported by other studies (e.g. 56%; Alam, 2001). ii) despite their important services, a small amount of consumer's price (5%) was shared by the a total of five other stakeholders (*Kuli*, cleaner, helper, water supplier and *Koilder*), who are considered as the poorest in the society. This share of consumers price for each category of intermediaries was again similar in both Mymensingh and Dinajpur iii) although retailers received highest proportion (about 13%) of the consumer's price among the intermediaries, the small volumes traded by such individual retailers meant modest returns (USD 2.5/day) iv) auctioneers, the only primary investors in the marketing chain, received about 4-7% of the consumers price, in return of their important role of organize the auction, providing credit to retailers and fish farmers on trust, without mortgage or even without proper written documentation (CARE, 2001). Despite less than one fourths share of the consumers' price, marketing intermediaries provided important services and investment at a significant level of risks. Due to consumers preference most (70%) fish are consumed in its fresh form and as fresh fish is highly perishable marketing transactions of fish need to be efficient (Rahman, 1997).

The auction markets, where all level of stakeholders gather for trade, were not only a place for exchange of fish products, but also as an important centre for exchanging knowledge and information of technologies and practices, production inputs, demand and price. Development of auction markets as an organised centre for information could be a effective strategy for aquaculture development.

Despite several above positive features of fish and prawn marketing, some weaknesses are notable and require improvement for further efficiency gains. Marketing information is required for all level of stakeholders in efficient functioning of markets and regulating the competitive marketing process. There is no formal information system found in the value chain for both prawn and fish marketing from where stakeholders can access information. Consequently a number of problems were encountered, particularly by small-scale farmers, due to lack of demand, supply and price information. For example the study found that prawn farmers were cheated sometimes by intermediaries due to a lack of knowledge and information of fluctuations in the international price of prawns. Sarker et al. (2006) found a negative relationship between availability of market information sources and barriers faced by fish farmers in developing entrepreneurship.

Developing smooth information systems as well as making the marketing information available to farmers would greatly enhance farmer's empowerment in bargaining for their product (FAO-DFID, 2002). Up-to-date information on demand and consumers preference would also help farmers to continue review of product and production strategy. Therefore, marketing information need to be delivered in understandable way for farmers and other stakeholders (Kuhlmann and Brodersen, 2001).

Lack of information also can lead to an unequal distribution of products resulting in oversupply or under supply to different markets and regions (FFTC, 1994). Distress selling of fish and prawns by farmers was evident. Channel intermediaries in fish and prawn were found to collect marketing information from each other, which was

sometimes biased by individual interest. More marketing information would also reduce transaction cost (Hobbs, 1997).

The market infrastructure was found to be very poor in all cases both fish and prawn and is another aspect that could be addressed to improve fish marketing. The facilities in fish markets in regard to space, shade, drainage, sanitation and water supply are extremely poor and unhygienic (Ahmed et al. 2005). The situation is particularly unsatisfactory in the rainy season. While the improving road communication has increased farmers' access to markets, farmers in remote areas experience less competitive price for their products as access to better urban markets is more problematic (Sarker et al. 2006). Sarker et al. (2006) found poor market facilities including roads are a barrier for remote farmers.

Prawn quality control is an increasingly important issue in the sector both nationally and internationally (Rahman, 2001; Dey et al. 2003; Khatun, 2004). Although a number of initiatives were taken to meet SPS standard, the study found that the post harvest handling and storage is still inadequate. As a result Bangladeshi shrimp exporters continued to suffer from real problems of negative reputation for quality leading to a low coverage in world markets (Bayes et al. 2005). The stakeholders, including farmers require more knowledge and skill regarding prawn quality control if premium prices for prawn are to be ensured.

6.4.3 Employment in the marketing chain and livelihood impacts

Agricultural growth creates synergies for diversification of the rural economy and development of the rural non-farm sector with greater poverty-reduction impact. Aquaculture growth and employment in fish marketing is evident. Fish and prawn marketing providing important livelihoods in rural areas. Rural employment in Bangladesh is in the process of structural change with non-farm employment playing a significant role as agriculture alone is not be sufficient to provide livelihoods in the rural areas in a situation of declining per capita land holding (Rahman, 2004).

Jayaratna (2004) reported that about half of the household income for poor rural families from developing countries derives from non-farm employment.

The study revealed that, the non-farm employments generated in the marketing of aquaculture was significant in the rural economy and/or rural livelihoods in Bangladesh. At least four reasons can be identified in the study. Firstly, employment contributed to reducing under and unemployment in rural areas. In Bangladesh, the labour force grew at a much higher rate than the population and demand for labour. During 1961-1991, the total population increased from 50.8 million to 111.5 million, an increase of 120 percent, while the labour force grew from 16.9 million to 51.2 million – an increase of 203 percent (ADB, 2001). However, there was not much difference in employment opportunities in fish marketing between Mymensingh and Dinajpur. On average about 100 people were working in each auction market (including retailers who buy fish from the auction market) and about 20 people (retailers and cleaners) in rural formal markets. On average there were eight people employed at depots in prawn marketing. The rapid growth of informal roadside markets was also significant. In the Bangladeshi context the employment opportunities in fish and prawn marketing is critical to rural livelihoods.

Secondly, rural poor people had access to the fish marketing employment. The study found that more than three fourths of the people involved in fish and prawn marketing, except auctioneers and depot owners were poor, while the cleaners, who tended to be lower caste Hindu people and labourers were the poorest in the society. Khatun (2004) noted a similar finding. In general, non-farm employment in big industries, businesses and services are mostly based in city centres and access to employment opportunities are more restricted for rural people, particularly unskilled labourers (Hossain, 2004a). Whereas most of the employment in marketing was manual based. There were no major entry barriers either for business (eg, retailing fish) or as employees (eg, no registration), except obtaining a selling spot at markets. The growth of markets counteracted this last potential constraint to some extent. The

study found that many of the stakeholders worked part-time or seasonally, professional fishers retailing fish during their lean period in fishing in open waters. Other fish retailers were involved in retailing vegetable part-time, which was an important strategy for smoothing incomes. It has been concluded that entry barriers to non-agricultural employment for the poor that occur in many countries tends to slow the rate of productivity and economy (NRI, 2003; Buttner, 2006). The stakeholders involved in fish marketing were from different backgrounds, indicating that the opportunities were not restricted to certain groups or classes. Buttner (2006) noted two types of entry barriers; first, there exists a public sector which is subject to regulations which protect this part of the economy against entry competition and second, the regulation for market entry is costly not only in terms of entry fees, but also time-consuming for administrative procedures to start a new business (Djankov et al. 2002; Buttner, 2006). Finally, people from educationally deprived sections of any community would find these barriers more problematic.

The significance of the employment in the marketing chain was that it brought individual household welfare including economic benefits. The welfare comes through mainly income from the marketing employment, which constituted up to about three quarters of total household. With the changing rural economy the share of non-farm income for the rural households is increasing. Over the 1987-2000 period household incomes grew at 3.8 percent per year, but income from non-farm activities increased at 6.8 percent per year compared to only 1.4 percent per year growth in agricultural incomes (Hossain, 2003). A similar observation was made across the three study sites.

Along with income generation, non-income dimensions were also important in livelihood welfare. Two aspects can be highlighted; firstly, having the opportunity to work closer to home is an advantageous for many of the stakeholders, who used to work and stay away from home, were able to stay with their family. Secondly, as markets tend to operate either in morning or in the afternoon, those involved had

spare time to be involved in other productive activities like agriculture, livestock rearing, fish culture etc as well as some social activities. However, when the overall reasons of working with fish and prawn marketing are compared, it shows a similar pattern across the three study sites.

These contributions of income and non-income attributes improved the livelihoods of the vast majority of stakeholders (85%). In addition to improved basic needs, the employment helped to improve the asset base of stakeholders, through investment in agriculture (including buying land) poultry, livestock. Improvement in social status, interactions and networks were also established through fish marketing and highly positive for enhancing social safety nets, particularly among poor stakeholders. Smith (2000) observed discrimination against the poorest, who suffer a lack of (useful) social networks and are, therefore, unable to capitalize on informal opportunities and remain excluded from formal support systems. Fafchamps and Minten (1998) demonstrated that social networking raised total sales and gross margins for traders. A similar pattern in improvement of livelihood outcomes was observed across the study sites. While in general the findings of the study confirms that the employment generated in the fish and prawn marketing was significant in securing greater livelihoods and improved welfare, livelihoods of some stakeholders' were also found to remain vulnerable and even deteriorate mainly due to ill health and dowry requirements related to marriage. Improvement in public and NGO support in health, education, infrastructure and social awareness is essential for sustaining and enhancing the employment and welfare of the stakeholders.

In Bangladesh about one million people are entering the labour market every year and half of them are located in rural areas (Wallich, 2003; ADB, 2001). Given the characteristics of the rural labour market and the structure of farm holdings dominated by small and marginal farmers, it is necessary to improve the prospects of rural households for increasing both farm and non-farm incomes. While productivity-enhancing investments in agriculture is critical in raising farm incomes, increasing

non-agricultural income for the land-poor households can release important internal dynamics of raising their household income and increasing agricultural productivity. The access to non-farm income not only raises household income but also increases the household's capacity to invest in agriculture. It is likely that farm households having non-agricultural sources of income will invest more resources in agriculture. It is important for Bangladesh to expand productive non-farm employment opportunities in rural areas, for which investment in education and development of skills of the poor are necessary. The process can create significant avenues for addressing poverty of the rural people. Investments in education and human resources development will enhance the access of the poor to remunerative non-farm employment and which would result in higher family income and would encourage increased agricultural investments leading to higher productivity and farm incomes added to non-agricultural income.

Hence, it can be concluded that fish and prawn marketing in Bangladesh is not just a flow of products but rather has significant impacts that run through society particularly through generating employment. The intermediaries involved are not just profit takers instead, for small returns they are providing valuable services to fish farmers ensuring markets for products and ensuring consumers welfare by distributing fish in both rural and urban areas.

CHAPTER 7 Limitations of research framework, summary and the way forward:

7.1 Limitations of research framework

Rural livelihoods in Bangladesh are inherently complex due to the heterogeneity of many aspects of life. It is commonly perceived that the livelihood concept provides an opportunity to understand these complexities. The current study therefore initially set out to use the SRL concept as its analytical framework. Limitations in time and resources however meant that a complete analysis based on the five major components of the framework namely i) vulnerability context, ii) livelihoods assets, iii) policies, institutions, processes, iv) livelihood strategies and v) livelihood outcomes) was not possible given the focus of the funded study on marketing. Broader community level information, such as institutions other than fish marketing, agricultural activities other than aquaculture etc. were largely not captured in the study due to the specific focus on aquaculture. In addition to this, as market networks and the intermediaries involved often extended beyond the focus community, limitations in logistics prevented more complete data collection.

Baud (undated) notes that the livelihood framework advocates a holistic approach in addressing poverty and that in practice many integrated studies are required for any focus on one particular aspect. He challenged the practicality of livelihood studies being able to apply a multi - sectoral approach. The study of fish marketing represents a particular challenge as the product flows through different channels, process, stakeholders and communities.

The livelihood concept is subject to criticism (Baud, undated). There is a great deal of discussion of how the DFID framework should be employed in practice. It is suggested that the framework should not be over institutionalized as it has limitations

in its ability to capture external changes (Ellis 2000; Beall, 2002). Limitations of using the framework were also documented in terms of its approach to analysis and measurement of capital assets. It is also insufficiently directed to the mechanisms for poverty alleviation, and offers no guidance on linking micro and macro levels or policy analysis (DFID/FAO, 2000). Marzetti (2001), based on her experience of trying to use the livelihood framework in Brazil, commented that the 'policies, institutions and processes box (in the framework) is too full and is an area where potential actions get lost'.

Some literatures suggest alternative categories of capital. To Baumann and Subir (2001) political capital should be given equal status with other capitals. This refers to a more structured and rigorous analysis of power within consideration of policies, institutions and processes. They argued that a sound definition of social capital would necessarily include a consideration of power and political relationships. Shankland (2000) suggested that the vertical dimension of social capital needs to be recognized in order to connect livelihoods analysis with policy making. Cleaver (2001) also explains that people create new institutions using elements of existing social and cultural arrangements, demonstrating the potential complexity of institutional reform.

While the practical evidence suggests the limitations of operationalising the livelihood framework, different institutions appear to value different forms of capital according to their own priorities. The World Bank (1997) appears to emphasize the importance of social capital in the development of economic capital. Bryceson (2000) argued that it will be more productive, in terms of poverty reduction, to work on raising human capital. In contrast, Beall (2001) claims that conceptualizing assets in this way reduce them to a neo-classical economic concept. Dividing people's livelihood simplistically in terms of assets may have only superficial value. For example a one-off inventory of assets may mask the relationships between assets and how this might change over a lifetime, and whether having high levels of one particular asset may compensate for low levels of another asset.

The livelihood analysis puts emphasis on participatory approaches for research and development. The current study used a mix of participatory tools for collecting data on the production and marketing of fish. While these techniques are advantageous in understanding the complex and dynamic rural livelihood patterns they had some drawbacks (Kapoor, 2002; Hayward et al. 2004). In some cases, ensuring participation was found difficult as some of the participants were reluctant or less able to participate, while some others felt hesitant to express their opinion. In contrast, in some cases individuals tended to dominate and interrupt the participation of other people or interrupt the smooth flow of discussion or other activities. Participation of individuals within group PRA activities can be influenced by their age, sex, profession, institution etc. (Chambers 1995). However, it remains a question of at what level of participation is acceptable and who decides it. The triangulation of PRA derived data through questionnaire surveys of individuals, observation of market actors and an on-going dialogue with key informants was used to strengthen the methodological approach.

7.2 Scaling up of key findings:

Although the study was conducted in four villages at each site, the findings can be generalized up to regional boundaries as the study villages were sampled purposively from different thanas of each district. According to geographical and climatic characteristics and prevailing aquaculture practices, the study findings in Dinajpur can be generalized for the northwest region covering greater Dinajpur and Rangpur districts, while in Mymensingh findings can be generalized for Jamalpur and Tangail districts and Jessore findings can be scaled up for part of the Greater Jessore district. In addition, some of the common features that were found in all sites can be generalized at the national level. The regional and national perspectives of the main findings of the study are outlined below;

7.2.1 Aquaculture production

In general, household based aquaculture production in Bangladesh was found to have intensified over the years, and at a faster pace over the last decade. The intensification occurred through improving pond management practices, applying the experience gained by farmers and the use of higher inputs including labour. However, there was regional variation in the level of intensification; of the three sites intensification was greater in the Mymensingh and Jessore region than the Northwest. Although, NFEP activities contributed to aquaculture development in the northwest region, it remained much less intensive than in Mymensingh. This was because most ponds are seasonal and winter is longer than in the other regions, and agricultural crops, mainly rice and vegetable cultivation dominated the farming systems and rural economy in the northwest. The labour market was also largely dependent on crop production. Yet, rice-fish farming was well established in several areas of the northwest and the number of rice-fish farmers had gradually increased.

7.2.2 Positive impacts of aquaculture

Findings from the study sites confirm that the intensification of aquaculture in Bangladesh was significant in improving overall livelihood outcomes of stakeholders in general and food security for farming households in particular. However, the role of aquaculture in household economies differed between the aquaculture systems practiced in different regions. Overall *Gher* outputs had a greater role in household economy and consumption than fish culture in ponds. Although prawns are primarily a commercial product, when prawn farming is integrated with fish culture and agriculture like rice, vegetable and fruit cultivation, it can be significant in terms of household food security and income. More importantly, it helps to maintain a good environment unlike fully commercial shrimp farming. Pond fish farming in Mymensingh was also found to have significant impacts on household income and consumption.

In general, women's participation in aquaculture was found to be significant. Although *pardha* norms still govern women's mobility and participation in income-producing activities in rural Bangladesh, women were found to actively participate in many fish culture management activities. Women were found to work as substitutes for hired male labourers in harvest and pond repair activities. This suggests that traditional social norms are changing in favour of women's participation in income generating activities.

The positive impacts of aquaculture were found to spread beyond farming households through generating livelihood opportunities in rural areas. As a direct effect, improvement of aquaculture increased demand for labourers and fishers over the last decade.

7.2.3 Fish marketing

Farmers' practice of selling their fish through multiple market outlets (auction, retail and roadside markets) found in the study can be generalized for most rural farmers in Bangladesh. The direct selling fish to *Dhaka party* (auction markets in Dhaka) by fish farmers in Mymensingh was a recent development in farmers' marketing dimensions and can be generalized for the central region (districts around Dhaka). In contrast, farmers marketing practices in the northwest were still influenced by traditional local practices to some extent.

Market demand for fish in terms of size according to species was found to influence farmers' production strategies. Fish farmers in Mymensingh were found to produce rohu and mrigal (0.8 – 1.0 kg size), catla and silver carp (1.0-1.5 kg size) because producing these sizes was most profitable. More commercial farmers adopted multiple stocking and harvesting to increase yield and income, and to benefit from seasonal price variability. Such awareness of fish marketing strategies was probably

influenced by NGO and donor supported development activities (Kar and Datta, 1998; Zellea et al 1998). However, in general, richer farmers were better able to gain benefit from the above mentioned opportunities.

The study findings show that when farmed fish were transacted locally, marketing was fairly efficient and farmers gained two thirds of the retail price. A small proportion (5%) of retail price was shared by very poor people, mainly involved in the fish auction process.

The study found that auction markets were not only transaction centres, but importantly also supported fish production and marketing in different ways; such markets were centres for information exchange regarding sources and prices of inputs, fish demand, supply levels and prices. Mobile phones are now playing important roles in information exchange among traders. In addition to providing information, auctioneers were the major investors in the supply chain providing credit to both farmers and retailers without any collateral. This increased the number of buyers and increased competition within the bidding process (CARE, 2001). The credit to retailers also allowed poor people, like retailers to enter the business without prior capital investment.

7.2.4 Employment in aquaculture and marketing

The recent development of aquaculture in Bangladesh has had multiple direct and indirect impacts on rural employment. Although the impacts are mostly positive, there are some negative impacts at various levels (section 7.3). Intensification of aquaculture over the years has generated employment opportunities for poor rural people and such opportunities have increased over the years. However, the opportunities generated in *gher* farming and pond fish farming Mymensingh region were much higher than those observed in the northwest to date.

The most important aspect of these enhanced forms of employment was that some of the poorest rural people have been able to access such benefits. Wage labourers and professional fishers, are two groups of poor people that stand out in terms of being most directly benefited from the intensification of aquaculture over the last decade. These employment gains were particularly important for fishers in the context of declining natural fish stocks and access to open waters for fishing. The benefits for fishers derived from diversifying livelihoods towards pond harvesting and in fish/prawn marketing. Many of the fishers shifted their main profession to harvesting ponds, while some others concentrated on opportunities in marketing, particularly fish retailing. The fishers, who had their own nets and/or additional income sources like agricultural land, mostly retained fishing in open waters as their main profession. These fishers tended to be better-off prior to the recent development of aquaculture. Some of the fishers in the Jessore region changed their profession to prawn marketing by establishing *depos* or were employed in *depos*. In addition to labourers and fishers, van pullers and input suppliers benefited from the increasing demand for transport and transactions of fish products respectively in the rural areas.

Fish and prawn marketing also provided critical livelihoods for rural resource poor people. The increase in numbers of people involved in marketing observed at all three research sites indicated the trend of generating new employment opportunities in the aquaculture sector in Bangladesh, which was derived from increased production, product transactions and the growth of markets. On average, there were about 100 people involved in fish marketing in each auction market and about 25 people in each rural retail market. Analysis of the profiles those involved in fish and prawn marketing showed that rural people had access to those opportunities. Income levels and the asset base for intermediaries indicated that vast majority of the people (about 90%) involved in rural and district markets, except the auctioneer/*depo* owners, were poor. In addition to their direct employment in marketing, service providers like ice

suppliers and transport people, particularly van pullers also benefited from the transaction of products.

Employment in the aquaculture sector was found to be critical for the rural poor both for survival and improving their living status. In particular, employment reduced the seasonal income vulnerability of stakeholders.

7.2.5 Building the asset base

The development of aquaculture not only enhanced rural livelihoods and contributed to improving the basic needs of the majority of stakeholders, but also assisted in improving the asset profiles of stakeholders in several ways. The majority of stakeholders were found to invest their increased income in both farm and non-farm activities to increase their income as well as their overall livelihood asset base. Whilst investment in livestock rearing was most common, some of the poorest stakeholders were found to buy own homestead land and many of the rest bought crop land. Although building assets through the above ways is common throughout rural Bangladesh, many poor stakeholders in the Jessore region leased gher and became involved in prawn farming.

In addition to the above on-farm asset building, some of the marketing intermediaries and farmers invested in non-farm income activities. The non-farm income opportunities in Bangladesh have increased rapidly over the last two decades, influenced mainly by improvement of infrastructure and road communication. The greatest development was observed in the service sectors (Toufique and Tuton 2003). Utilizing those opportunities some stakeholders established tea/grocery shops at villages or local markets. Some others bought and rented out vans. In general richer stakeholders were better able to gain from such opportunities. A study on prawn farmers in Noakhali district conducted by Demaine (2003) also noted similar findings. Demaine (2003) found that prawn farmers invested in improving their assets, for example 16% farmers invested in business, 14% bought land, 12% bought livestock

and 10% constructed ponds. The study found some better-off farmers invested in water pumps for providing rental income. These investments also generated more livelihood opportunities in rural areas. For example, repairing water pumps created opportunities for mechanics (Toufique and Tuton, 2003). This was particularly important in the northwest region.

Along with improvements in physical assets, increased income contributed to improvement of the human capital of stakeholders through improved food consumption, health care and child education. Skills developed through working with aquaculture in some cases contributed to secure alternative income sources. Experience gained in working with *ghers* facilitated some labourers to become part-time farmers through leasing in arrangements. About 10% of fish retailers were found to retail other agricultural products, especially vegetables when the availability of fish in the market was low. Skills gained through working with ponds may become important to secure permanent employment in more fully commercial farms.

Social impacts were also found to be significant in the study. Employment in aquaculture production and marketing was found to contribute to improved social capital to a great extent. While, in general social capital was improved in several ways for all levels of stakeholders, it was particularly enhanced through exchanging gifts, inviting friends to the home and giving short term loans to relatives or friends. This was greatly influenced by increased incomes. Social relations of farmers were improved with increased interactions among farmers through sharing experience and inputs in general and guarding *ghers* at night, among *gher* farmers in particular. Increased farm input use and marketing of products also increased human mobility for all stakeholders, which in turn increased interactions with different types of people, awareness of, and access to, information. Increased human mobility also generated opportunities for service providers, like small restaurant or tea shop keepers, van/rickshaw pullers etc.

The growth of markets in rural areas provided intermediaries with an important opportunity to work closer to home, allowing them to stay with families, reducing travel time and cost, and increased interaction with local people that in turn enhanced social capital. Such opportunities might be expected to increase with further growth of markets.

7.3 Negative impacts

Although intensification of aquaculture over the last decade mostly enhanced rural livelihoods, it had some negative impacts on livelihoods and environment. The study concluded that the horizontal expansion of private aquaculture into *beel* areas (those which were previously open-access fishing ground in the rainy season) impacted negatively in two ways; i) reduced open access of fishing for poor people and ii) construction of high dikes in *beel* areas interrupted natural water flow in the rainy season and migratory movements of wild fish resulting in a reduced natural harvest. Thus expansion of aquaculture reduced livelihood opportunities for professional fishers. As a result, many of the previously full time fishers switched their main profession to harvesting ponds, while the rest were involved part-time in fish marketing or alternative income activities. Fish from such open waters was particularly critical for the poor and especially those who did not have own aquaculture resources. Sultana and Thompson (2000) found that the majority of rural households living around *beels* (i.e *beels* with traditional or unmodified management and access rules) were involved in fishing for about 50% of their time during the rainy season, which was critical for household consumption and in some cases income generation.

Although intensification of aquaculture over the last decade did not appear to have major social implications in the study regions, several studies suggest that highly commercial prawn/shrimp farming in the coastal area (Bagherhat, Khulna and Shatkhira) impacted negatively on society (Zaman, 2000; Islam and Haque 2004). In

many cases land ownership was changed and many poor farmers were forced to leave farming by selling/leasing out their *gher*, most commonly to richer and more powerful people from the outside communities. Similarly local labourers and fishers were replaced by incomers by such non-local *gher* operators (Zaman, 2000; Khatun 2004). However, such consequences were not observed in the Jessore region in the current study. This may be because the *gher* farming was established fairly recently and the land ownership and social bonding remained strong in Jessore (Rahman 2002). Another recent study in the northwest region suggested that one of the reasons some poor farmers leasing land for rice-fish farming abandoned the practice was that the rice-fish plot was taken back by land owners (Haque, 2007). Therefore, it can be suggested that scaling up of aquaculture to fully commercial farms may have major implications for the rural poor who had gained access to land on a temporary basis.

In the case of marketing, increased direct selling of fish/prawn in fish markets/*depos* by farmers greatly reduced the role and livelihood opportunities for *nikaris/foiras* (middlemen buy fish/prawn at farm gate). Therefore, many of them left the profession entirely or became involved in other activities in fish marketing like retailing.

7.4 The way forward

7.4.1 Pond aquaculture and marketing

The current trend of intensification of aquaculture in household based ponds, as observed in the study, is expected to continue in line with increase in demand for fish in domestic markets due to a growing population, rapid urbanization and increased income levels in Bangladesh. Intensification of such pond aquaculture may occur both vertically through greater input use for higher production and horizontally through constructing new ponds, particularly in low lying lands. As found in the study, such intensification may generate important livelihood opportunities for the rural poor throughout the value chain. However, if such intensification, particularly commercialization continues to grow, there is the risk that negative consequences may

appear in rural livelihoods and the environment. Commercialization may increase competition among the farmers for resources, which may create barriers for small-scale farmers in sustaining in fish farming, particularly for poorer farmers who lease ponds. This may even result in poor fish farmers leasing out or selling their resources to richer farmers. Richer farmers may then be more likely to establish fully commercial farms in rural areas in the longer term. Further development in the amount and intensity of pond-based aquaculture through conversion of rice fields to ponds can lead to both deterioration in land and water ecosystems, and reduce access to fishing in open waters for poor people. More environmental and social implications may be likely to appear more at this stage.

Fully commercial farms, like those established along the Dhaka-Mymensingh road may be extended along the other *paka* roads to Dhaka in the central region (districts around Dhaka). At the same time the existing commercial farms are expected to intensify their production and profit. Such farms will be fully market oriented and may be better connected with markets through the modern information technologies (IT). Therefore, they will be more capable of adopting production strategies as the market demands and may capture more lucrative market sectors with fast growing high value species, which require access to investment and technical knowledge. On the other hand, small-scale farmers may find it difficult to access marketing information due to the current costs of accessing IT and information. This means that small-scale farmers may be relatively disadvantaged in their attempts to access larger markets and secure higher prices. However, it is also likely that the cost of IT and information will reduce in future. Promoting IT infrastructure accessible to small-scale farmers could enhance the sustainability of small-scale in increasingly competitive markets. While the real fish price is expected to increase in future due to increased demand for fish and declines in the natural harvest, the cost of inputs will also increase simultaneously. Therefore, along with availability of inputs, like fish seed, feed, etc. at low cost, markets that work for the small-scale farmers will be

critical. A holistic support, which includes improved technologies and all inputs and credit to implement the technology, is needed for the small-scale farmers to build capacity in order to compete with commercial farms for sustaining the gains from aquaculture development found in the study.

Direct links of fish farmers to Dhaka and other city markets is expected to increase and expand in more areas. This also may influence faster growth of commercial farms. Although such direct links may assist fish farmers gaining better prices, employment opportunities for poor intermediaries may decline as a consequence.

From the above expected future context the following research and development factors can be identified;

- The current trends indicate faster growth of commercial farms in the near future, which may affect the current farming dynamics such as species cultured, input use etc. as well as market dynamics. Therefore, it is important to assess impacts of growth of commercial farms on small-scale farmers, overall demand and supply of fish in markets and rural livelihoods, and poor consumers. Development of strategies and interventions are important to build capacity of small-scale farmers to face future challenges for sustaining benefits from aquaculture for the poor.
- Develop marketing information system, which will include gathering, processing and delivering information on demand, supply and price of fish. The system should also provide information on opportunities for developing marketing services and employment. The system should assess the priority information needs for all levels of stakeholders throughout the value chain and deliver the information to different target groups in their understandable form.
- Assess the impact of direct links of commercial farms and richer farmers to Dhaka and other city markets on broader marketing systems and intermediaries. These links may undermine market opportunities for the poor and reduce fish availability to rural

markets as well as reduce employment opportunities. Therefore, strategies should be developed for sustaining the employment and welfare of poor intermediaries in future changes in marketing dynamics, while not undermining the fair price of both farmers and consumers.

- Diversification of livelihoods for the rural poor is critical. In order to improve overall livelihoods of stakeholders in the aquaculture industry, support is needed to identify appropriate non-farm opportunities to diversify income sources for all level of stakeholders. So that they are also able to cope with short term risks and sustain in aquaculture sector.

7.4.2 Rice-fish farming and marketing

Although aquaculture in the northwest region is expected to continue to intensify in the longer term, the actual growth may remain slow compared to the other regions studied. The biggest problem that farmers have to face is competition for both surface and ground water, particularly as the water retention capacity of the soil in the northwest region is low. Competition for water will continue to increase between irrigated *boro* rice, and activities such as vegetable production and aquaculture intensification. Therefore, fully commercial fish farms may not grow as fast as in other regions in the near future. Rather rice-fish farming is expected to expand gradually. Raising fingerlings in the rice field is a potential area for expansion in the near future as it was found to be feasible and profitable, and significant to farming households. However, expansion of rice-fish farming may have implications for farmers leasing rice land. In a recent study Haque (2007) found that in some cases the owner took back potential rice-fish plots from lease farmers once the benefits of the approach were more widely appreciated.

Marketing of fish in local markets may not be a problem for farmers. This is mainly because current local production is insufficient to meet the demand for fish in the region and a large amount of fish is imported from different districts. However,

auction markets can be developed as an important centre for information regarding input prices, fish demand, and supply and the wider price situation both for traders and farmers.

From the above expected future context the following research and development factors can be identified;

- Improvement in the water-use efficiency of integrated agriculture-aquaculture farming systems.
- Development of community based rice-fish in the northwest region that will include the poor non-farmers.
- Development of rice-fish farming, which require high dikes, may affect the water flow in the rainy season, overall eco-system and species dynamics including fish of low lying areas as access to will fish for the poor. Therefore, assessing impacts of rice-fish farming on wild fish and access to wild fish for the rural poor are important for future investigation.

7.4.3 Prawn farming and marketing

The positive impacts derived from *gher* farming solely depend upon international demand for the product. If the demand continues to rise or even stabilizes, the existing *gher* farming may become more intensified in Jessore region. The major intention of such vertical intensification may be to increase prawn production (higher density, more commercial feed use etc.), which may result in reducing interest in growing other crops generally integrated within exiting *gher* systems like fish and particularly rice. However, if intensification continues in future, environmental and social implications may appear at some point. While richer farmers are expected to cope and progress during the process, small-scale farmers will be in a more vulnerable position.

Ensuring good *gher* management practices and building awareness of the socio-economic and environmental consequences of poorly designed intensification are the

key for sustaining the gains from *gher* farming as identified in the present study. Good *gher* management practices and farm efficiency can be improved using environmentally friendly approaches (GOLDA, 2001) such as stocking prawn juveniles at low density in *ghers* and combining their culture with finfish. This allows prawns to reach a large, more valuable individual size. Such developments can also be combined with promotion of HACCAP regulations, which will help to address traceability issue (identifying origin, history and level of contamination in the value chain) to the farm level and may further increase prices of small-scale farm products. However, poor farmers should be supported financially and technically to improve farm efficiency and coping strategies for implementing such programmes in practice. Evaluating future environmental and social changes is important for investigation and feed back.

If the international demand of prawn remains high *gher* farming might be expected to expand over greater areas of the southwest. In addition to *gher* systems, prawns might also be produced in homestead ponds.

With further increases in production, the numbers of prawn *depos* might be expected to increase along rural roads, which will generate more jobs for rural poor. However, as post harvest handling and storing were found to be generally inadequate, more emphasis should be given to improve quality of prawn at different stages in the marketing chains.

Marketing information particularly regarding the international demand and supply situation, and delivering early and clear signals to all stakeholders is necessary for improving exports and sustaining the sector. This will require government and donor involvement as it will need large investment. At the same time exporters, with the assistance of government, need to find new markets for sustaining growth.

From the above future projections the following research and development factors can be put forward;

- Although the *gher* farming in Jessore is currently eco-friendly, production levels are still low. Improvements in farm efficiency which can maintain the inherent qualities (large, individual sized prawns produced mainly on natural feeds in systems that maintain multiple utility) are required
- Develop mechanisms to minimize social negative aspects and sustain social gains. Professional groups or co-operatives may assist in this regard.
- Adoption of prawn farming in homestead ponds and impact on fish farming (change in fish production, feed, species dynamics etc.)
- Improvement of post-harvest handling, storing and transport in order to maintain post-harvest quality of prawn. However, required support (technical and financial) should be given to stakeholders to improve and to maintain their systems.
- Developing suitable market information system, which includes both domestic and international market information, and delivers information to different level of stakeholders in an accessible form.

The micro-level findings of the study indicated aquaculture production and marketing have significant impacts on enhancing rural livelihoods in Bangladesh. Effective future aquaculture development should ensure that the benefits are sustained and even improved. The current study explored micro-level strengths and weaknesses of existing aquaculture production and marketing and suggested priorities for further research and development initiatives. Finally, poor stakeholders including women involved throughout the value chain require particular attention if aquaculture potential is to be capitalized effectively as a strategy of poverty reduction in Bangladesh.

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Appendices

Appendix 1: Baseline questionnaire for fish farmers

Farmers Profile

Date	Interviewer	Checked by

Village	Union	Sub-district (upazila)	District
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Other persons present during the interview				
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Wellbeing (put ▼)	1		2	
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Group (put ▼)	Pond/gher/rice-fish		Non pond/non-gher/non-rice-fish
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Basic information:

Family head	Father/Husband
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Distance of pond/gher/R-F plot from the house (m)	i) 0-10 m	
	ii) 10-100m	
	iii) 100+ m	

Household profile

Name	Age	Education	Gender	Main activities in household

Household income: State and rank household income over last 2 years

Last year (2002)			Year before last year (2001)		
Sl	Product/Service/Business	Estimated income	Sl	Product/Service/Business	Estimated income
	Rice				
	Prawn/Gher				
	Fish (Pond/rice-fish/gher)				
	Livestock (selling)				
	Vegetable				
	Fruit (all)				
	Milk business (Goala)				
	Retailing agricultural products				
	Business				
	Service				

2.1 Give details of income information of targeted resources/system (pond/gher/rice-fish)

1. Crop/Service/business:	Source*	Who does it?
<p>How has the income from this source/crop changed over last few (5) years? If so, why?</p> <p>For crop only. Has marketing of the crop changed over last 5 years? If so, describe how?</p>		

2. Crop/Service/business:	Source*	Who does it?	Estimated amount (TK)
<p>How has the income from this source/crop changed over last few (5) years? If so, why?</p> <p>For crop only. Has marketing of the crop changed over last 5 years? If so, describe how?</p>			

3. Crop/Service/business:	Source*	Who does it?	Estimated amount (TK)
<p>How has the income from this source/crop changed over last few (5) years? If so, why?</p> <p>For crop only. Has marketing of the crop changed over last 5 years? If so, describe how?</p>			

4. Crop/Service/busines: ss:	Source*	Who does it?	Estimated amount (TK)
How has the income from this source/crop changed over last few (5) years? If so, why?			
For crop only. Has marketing of the crop changed over last 5 years? If so, describe how?			

Resources and assets

3.1 Housing and housing equipments	Type	Put Tick
	Kacha (Earthen/Bamboo)	
	Kacha + Tim roof	
	Paka (Cement)	
	PakaToilet	
	Kacha Toilet	
	TV	

	Type	Number	Area and Ownership		
			Own (dec)	Leased in (dec)	Leased out (dec)
3.2 Land	Homestead				
	Crop				
	Pond				
	Rice-fish plot				
	Gher				
	Garden/forest (?)				

3.2.1. If the farmers has pond: What is the use of pond

Growing fish Bathing Irrigation Others (name) ...

3.3 Livestock and poultry	Type	Total number
	Cattle	
	Goat	
	Chicken	
	Duck	

3.4 Orchard (tree)	Type	Total Number

4. Overall livelihood trends:

4.1 How has your household overall livelihood over the last 5 years (Tick one)?

Improving Stayed similar Got worse

WHY? (Give details reasons)

4.2 In last five years, are there any major occurrences that have strongly effected your household, either positively or negatively except above. (if no answer prompt: flood, illness, fish/prawn disease/pest attack, dowry)

A.
Event description:

Why it happened

Effect on household

How did the household cope:

B.
Event description:

Why it happened

Effect on household

How did the household cope:

C.
Event description:

Why it happened

Effect on household

How did the household cope:

D.
Event description:

Why it happened

Effect on household

How did the household cope:

5. Institutional context (services and facilities):

6.1 What are the institutions (GO and NGO) working in the village:		
i)	ii)	iii)
iv)	v)	vi)

.2 Do you or any of your family member get any assistance from them or do you involved with them?

Put "Tick" on appropriate box

YES

NO

5.3 If YES, please fill the following table and If NO, please X (cross) the following table		
Name of institutions you/your family getting assistance from	How are you involved and what support you are getting (from NGO)	What are the changes brought to your livelihoods with the above support (Impact)

Appendix 2: Monthly monitoring questionnaire for farmers

Monitoring questionnaire

Farmers Name:

Farmers Code:

Date	Interviewer	Checked by

Thana	Village	Farmers category

For the farmers who do not have pond/gher/rice-fish plot, start from question no. 3.

1. Activities carried out on pond/gher/R-F plot in last month

Activities	Who involved		Time spent
	Family members	Hired labour	

2. Input in pond/rice-fish field/gher last month

Name of input	For fish or rice	Source (name and address of supplier)	Who applied	Estimated total cost (Tk)
Seed				
Lime				
Fertilizer				
Rice bran				
Commercial				

feed				
Home made feed				
Labour				
Snail				

3. State and rank in order of important HH income sources over the last month

Income source	Member of household

4. Farm output/harvested products in LAST SEVEN DAYS: -

Species	System			Estimated average size (cm)	Utilization of farmed products (%)				
	Pond	R-F	Gher		Consumed (%)	Sold (%)	Store/processed (%)	Payment as Kind (%)	Gift to Neighbour (%)
Catla, rui and mrigal									
Silver carp									
Grass carp									
Tilapia									
Golda									
Shorputi									
Pangas									
Wild fishes									

4.2 What are the reasons of harvesting fish in last month?

4.3.1 Did you check the price and demand? YES NO

If yes, name and address of information supplier.

4.3.2 Who harvested the fish? (Name and address)

4.3.3 Why did you chose this harvest method?

4.3.4 Describe the harvesting contract.

4.4.1 Were the fish consumed by the household is same size and species as those sold?

YES NO

4.4.2 If not why?

4.5.1 For fish only				
Selling options	Who was involved in selling	Why this option is chosen	Describe detailed methods and contracts	Price obtained
Sold at farm gate				
Sold to neighbours				
Sold at village market				
Sold at thana market				
Sold at district market				
Local dipo				
Main dipo				
Sold to harvesting team or Fishers				
Others				

4.5.2 A. How long did it take to transport the fish to market?
minutes

4.5.2 B. Total cost of transportation:Tk.

4.5.1 For prawn only				
Selling options	Who was involved in selling	Why this option is chosen	Describe detailed methods and contracts	Price obtained
Sold at farm gate				
Sold to neighbours				
Sold at village market				
Sold at thana market				
Sold at district market				
Local dipo				
Main dipo				
Sold Fishers				
Others				

4.5.2 A. How long did it take to transport the fish to market?
minutes

4.5.2 B. Total cost of transportation:Tk.

5.1 What did you have in last three days? (Main food items)

Day	Breakfast	Lunch	Dinner
Yesterday			
Day before			
Day before			

5.2. If the farmer had food less than two meals per day. Give seasons:

5.3 Sources of main food items:

Food items	Source				
	Farmed	Natural/wild	Pond dike	Gift	Bought
Fish* (list the species and length)					
Vegetable					
Chicken					
Duck					
Milk					
Egg					
Rice					

5.4 Did you have fish in last month? If “ YESS” “NO”

If yes, How many times?

Every day 2-3 times /week 2-3 times /month Never

(Options will be identified during field test)

5. Did you face any shocks and/or stresses/ problem in last month: If Yes give details

What and why How	What is the effect	you overcome or plan for overcome

6. Did you attended any social party/gathering in last month? If yes give details

8. Questions regarding the next month

8.a. Will there be any harvests in the next month (e.g. from your rice/vegetable/ponds/nature?...) YES NO

If yes, please precise where and when:

Appendix 3: Questionnaire for marketing intermediaries survey

LIVELIHOOD PROFILE OF FISH MARKETING STAKEHOLDERS
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Date	Interviewer	Checked by

Respondent's name		Father's name	
-------------------	--	---------------	--

Job/Position's title	
----------------------	--

Company (Arot/Depo)		Employer's name	
---------------------	--	-----------------	--

Address	Permanent	Work place	Distance of work place from permanent address (km)
Vuil./Bazar			
Thana			
District			

1. FAMILY PROFILE:

Respondent's age	
Respondent's education	
Respondent's wife age	
Respondent's wife education	
Total no. of family members	
No. of earning members	

No. of school going children's	
No. of drop out children's (if any)	
No. children earning	

		Code
Reasons for drop out:	1	
	2	
	3	

Children's age ≤14 years

1.2 How other family members involved or supporting to perform his job? (Other than normal household care)

Sl.	Relation	How family member's supporting him	
1			
2			
3			

2. PROFESSIONAL PROFILE AND IMPACT:

2.1 How long have you been working for the present job? Years.

2.2 Is this your hereditary job? Put "✓" YES Or NO (if NO, then answer Q. 2.3 & 2.4)

2.3 How have you become involved with this job?

2.4 Professional experiences of the respondent: (list 4 previous jobs starting with the last job)

Sl.	Job title	Duration (Years)	Main reason (s) for changing job	Code
1				
2				
3				
4				

2.5 Respondent's other occupation and calendar chart for respondent's main, secondary and tertiary occupation (income generating activities) in a year (serial no. 1-3 from the list below); Put "X" in the table cells:

Job/Activities/crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

2.6 How is your livelihood changed during last 5-7 years? Put "✓" in the box

Improved Remain same Got worse

2.6.1 Reasons for change:

(Please, record on back of the page for details and transfer the information to above table according to importance immediate after the interview)

Sl.	Mention changes before involvement and then after involvement in the marketing chain	Code
1		
2		
3		
4		
5		

2.6.2 Indicators of livelihood changes:

Sl.	Mention changes before involvement and then after involvement in the marketing chain	Code
1		
2		
3		

4		
---	--	--

2.7.1 How is the environment (health and hygienic condition) at your work place?

Good		OK		Bad	
------	--	----	--	-----	--

2.7.2 Reasons for the answer:

Interviewer's observations regarding the health and hygienic condition of the work place:

--

3. TRENDS in job responsibilities and marketing:

3.1 What are the changes you have observed during last 5-7 years in **your work/responsibilities** and who it will likely be after 5-7years?

Topic/Items	5 years ago	At present	After 5 years	How it will effect your work and livelihoods
Workload				
Job competition				
Power relation				
Govt. policy				

3.2 What are the changes you have observed during last 5-7 years in **overall marketing of fish/prawn (seed)** and who it will likely be after 5-10 years? Who the changes will impact on your livelihoods?

	5 years ago	At present	After 5 years	How it will effect your work and livelihoods
Market size				
No. of people				
Information flow				
Road				
Transport				
Relationship				
contracts				

4. Problems and future plan:

4.1 Are you happy with the present job status and environment?

Yes		No	
------------	--	-----------	--

Reasons:	

4.2 What are the other main problems of your profession and overall marketing situation except above pre-season? How could those be solved?

Code	Problems	Solution	Code

4.3 What is your future plan regarding your job (profession)?	

5.1 FOOD CONSUMPTION:

5.2

How do you consider your household	Put "✓"	Meal / day	Duration (months)
Enough		3 meals	
Break even		3 meals but reduce amount	
Occasionally food deficit		2 meals	
Usually food deficit			

of Q. 5.1 and 5.2 :

5.3 Fish (prawn) consumption (estimation from recall):

	Peak			Average			Lean		
	Duration (Months: (From-to))	Amount per Day (kg)	Days Per week	Duration (Months: (From-to))	Amount per Day (kg)	Days Per week	Duration (Months: (From-to))	Amount per Day (kg)	Days Per week
Fish									
Prawn									
Prawn head									

5.4 Meat (other than fish) and Egg consumption:

Food Item	Days / months	Amount / day (kg)
Meat		
Egg		

6. HOUSEHOLD RESOURCES AND ASSETS

6.1 Land	Type of land	No.	Own (dec)	Lease d in (dec)	Leased out (dec)	Multi- owned (dec)
	Homestead					
	Crop					
	Pond					
	Rice-fish plot					
	Gher					
	Garden/forest					

6.2 Type of house and toilet (Sl no. put (✓) on serial number)	
1	Kacha (Earthen/Bamboo)
2	Kacha + Tim roof
3	<i>Paka</i> (Cement)
4	<i>Paka</i> Toilet
5	Kacha Toilet
6	No toilet

6.3 Condition of house Sl no. put (✓) on serial number	
1	Own house
2	Rent house
3	Built on others land
4	Built on khasland (Govt. owned)

6.4 Livestock and number (put no. in right)	
Type	
Cattle	
Goat	
Chicken	
Duck	

6.5 Transport and farm equipments	No
Bicycle	
Van	
Power tiller	
Water pump	

7. Household income:

7.1 List HH income according to importance and income in last year (Last year amon- this amon)

Sl.	Activities or job	Income in last year (Tk.)	Who was involved?
1			
2			
3			
4			
5			

8. List the expenditure (consumable) according to importance (amount) for a calendar year:

Sl.	items	% of total expenditure	Estimated amount in a year	Calculation space
1	Food			
2	Cloth			
3	Education			
4	Health / treatment			
5	Transport			
6	Fuel			
7	Housing			
8	Festival			

9. Involvement with NGO

9.1 Do you involved in any NGO or social welfare organisation?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
--	-----	--------------------------	----	--------------------------

If yes, fill the list below.

Name of NGO or social welfare organisation	How you are involved?	What is the ultimate impact in your livelihoods? (With reasons)	

Appendix 4: Inflation rates in Bangladesh

Inflation rates	
1997	3.96
1998	8.66
1999	7.06
2000	2.79
2001	1.94
2002	2.79
2003	4.38
2004	5.83

Source: Bangladesh Bank (undated) www.bangladeshbank.org

Appendix 5: Questionnaire for women survey

মাছ চাষে মহিলাদের অংশগ্রহণ

প্রাঙ্গের নাম:

১। নাম:

২। বয়স:

৩। শিক্ষা:

৪। মাছ চাষে কোন ট্রেনিং পেয়েছেন কি না? "হ্যাঁ" বা "না".

৫। মাছ চাষ বিষয়ে আপনি নিজে কি কি করেন? "√" চিহ্ন দিন

- মাছের খাদ্য তৈরী করি।
- মাছকে খাদ্য দেই।
- মাছ ধরার জন্য জাল টানতে সাহায্য করি।
- পুকুর পাড় ভেঙ্গে গেলে পাড় বর্ধিতে সাহায্য করি।
- পুকুর পাড়ে সবজি লাগাতে ও যত্ন নিতে সাহায্য করি।
- পুকুর পাড়ে সবজি লাগাতে ও যত্ন নিতে সাহায্য করি।
- অন্যান্য:
-
-

৬। কত বৎসর হতে এসব কাজ করছেন?-----বৎসর।

৭। মাছ চাষে প্রতিদিন কত ঘণ্টা ব্যয় করেন?

গড়ে:-----ঘণ্টা, সবচেয়ে বেশি-----ঘণ্টা, সবচেয়ে কম-----ঘণ্টা।

৮। মাছ চাষের কাজ করার ফলে আপনার কাজের চাপ কি বেড়েছে? "হ্যাঁ" বা "না"

৯। কাজের চাপ বাড়ার ফলে আপনি অসন্তুষ্ট কি না? "হ্যাঁ" বা "না"

কারণ কি?

১০। অন্যান্য কৃষি কাজে গড়ে কত ঘণ্টা ব্যয় করেন?

ক. হাঁস-মুরগী:-----ঘণ্টা। খ. পরু-ছাগল:-----ঘণ্টা।

গ. সবজি/(বাজে কৃষি):-----ঘণ্টা। ঘ. কৃষি:-----ঘণ্টা।

১১। মাছ চাষের ক্ষেত্রে আপনার স্বামী আপনার কাছে কোন পরামর্শ গ্রহন করেন কি? "হ্যাঁ" বা "না"
যদি "হ্যাঁ" হয় তবে কি ধরনের পরামর্শ

*

*

*

যদি "না" করে থাকে তবে কারন কি?

*

*

১২। মাছ বিক্রি করার পর আপনার স্বামী আপনাকে ইচ্ছামত খরচ করার জন্য টাকা দেয় কি না? "হ্যাঁ" বা "না"
কারন কি?

১৩। কোন কৃষি কাজে আপনার হাতে ইচ্ছা মত খরচ করার টাকা আসে?

*হাঙ্গ-মুরগী

* সবজি চাষে

* গরু পালনে

* ছাগল পালনে

* ফসল(ধান)

১৪। মাছ খাওয়ার সময় সাধারণত: কে কোন অংশ খায় বা কার পছন্দ সবচেয়ে বেশী শুরুতু পায়। কেন?

১৫। মাছ চাষ থেকে যে টাকা আয় হয় তা থেকে ব্যক্তিগতভাবে আপনি কিভাবে লাভবান হন?

১৬। মাছ চাষের সাথে জড়িত হওয়ার ফলে আপনার কোন অসুবিধা হচ্ছে কি না? "হ্যাঁ" "বা" "না"
হয়ে থাকলে কি কি?

ব্যক্তিগত:

পারিবারিক:

সামাজিক:

Appendix 6: Photographs of PRA and production and marketing activities

Photograph 1: Focus group discussion with *gher* labourers in Jessore



Photograph 2: Fish farmers is drawing the map of markets they used



Photograph 3: Women involved in pond dike repairing



Photograph 4: Women involved in prawn and fish harvesting



Photograph 5: Cleaner taking tax from retailer at roadside market in Dinajpur



Photograph 6: Transportation of food fish by fish retailers in Mymensingh